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ABSTRACT

This document presents a collection of field observations, from 11 sites, submitted as a part of the final report of a project funded by the National Science Foundation to gather data about science, mathematics and social science education in American schools. Schools involved a variety of settings: rural-urban, racially diverse, socioeconomically different, and located throughout the United States. Field observers spend 4-15 weeks on site, gathering data. Biographical information on each field observer accompanies his/her case study. (PEB)

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SE 78-74

Case Studies in Science Education

Volume I
THE CASE REPORTS

Prepared for:
National Science Foundation
Directorate for Science Education
Office of Program Integration

SE 026 707

This document is one of seven as listed below. They are reports of three complementary studies of the status of pre-college science, mathematics, and social science education.

1. The Status of Pre-College Science, Mathematics, and Social Studies Educational Practices in U. S. Schools: An Overview and Summaries of Three Studies SE 78-71
Stanley L. Helgeson, Robert E. Stake, Iris R. Weiss, et al.
Ohio State University, University of Illinois, and Research Triangle Institute

2. Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education SE 78-72
Iris R. Weiss
Research Triangle Institute

3. The Status of Pre-College Science, Mathematics, and Social Science Education: 1955 - 1975
Volume I: Science Education SE 78-73 Vol. I
Stanley L. Helgeson, Patricia E. Blosser, and Robert W. Howe
Center for Science and Mathematics Education, the Ohio State University

4. The Status of Pre-College Science, Mathematics, and Social Science Education: 1955 - 1975
VolumeII: Mathematics Education SE 78-73 Vol. II
Marilyn N. Suydam and Alan Osborne
Center for Science and Mathematics Education, The Ohio State University

5. The Status of Pre-College Science, Mathematics, and Social Science Education: 1955 - 1975
VolumeIII Social Science Education SE 78-73 Vol. III
Karen B. Wiley with Jeanne Rice
Social Science Education Consortium, Inc.

6. Case Studies in Science Education
Volume I: The Case Reports SE 78-74 Vol. I
Robert E. Stake, Jack Easley, et al.
Center for Instructional Research and Curriculum Evaluation, University of Illinois

7. Case Studies in Science Education
Volume II: Design, Overview and General Findings SE 78-74 Vol. II
Robert E. Stake, Jack Easley, et al.
Center for Instructional Research and Curriculum Evaluation, University of Illinois

CASE STUDIES IN SCIENCE EDUCATION

Volume I
The Case Reports

Chapters 1-11

Center for Instructional Research and Curriculum Evaluation
and
Committee on Culture and Cognition
270 Education Building
University of Illinois at Urbana-Champaign

January 1978

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The Project

Case Studies in Science Education is a collection of field observations of science teaching and learning in American public schools during the school year 1976-77. The study was undertaken to provide the National Science Foundation with a portrayal of current conditions in K-12 science classrooms to help make the foundation's programs of support for science education consistent with national needs. It was organized by a team of educational researchers at the University of Illinois.

Eleven high schools and their feeder schools were selected to provide a diverse and balanced group of sites: rural and urban; east, west, north and south; racially diverse; economically well-off and impoverished; constructing schools and closing schools; innovative and traditional. They were finally selected so that a researcher with ample relevant field experience could be placed at each. To confirm findings of the ethnographic case studies and to add special information, a national stratified-random-sample of about 4000 teachers, principals, curriculum supervisors, superintendents, parents, and senior class students were surveyed. Survey questions were based on observations at the eleven case-study sites.

The field researchers were instructed to find out what was happening, what was felt important, in science (including mathematics and social science) programs. On site from 4 to 15 weeks they were not required to coordinate their work with observers at other sites. Questions originally indicated important by the NSF or identified early in the field were "networked" by the Illinois team. Efforts to triangulate findings were assisted by reports of site visit teams.

Each observer prepared a case study report which was preserved intact as part of the final collection, and later augmented with cross-site conclusions by the Illinois team. The cost of the study was just under $300,000, taking 18 months actual time and about 6 research-person years to complete.

In the principal findings it was noted that each place was different in important ways, that each teacher made unique contributions. Nationally we found that science education was being given low priority, yielding to increasing emphasis on basic skills (reading and computation). Still, the CSSE-high-school science faculties worked hard to protect courses for the college-bound, with many of these courses kept small by prerequisites and "tough" grading. Only occasional efforts were made to do more than "read about" science topics in most of the elementary schools. Although ninth-grade biology and eighth-grade general science flourished, general education aims for science instruction were not felt vital at any level. Seldom was science taught as scientific inquiry--all three subjects were presented as what experts had found to be true. School people and parents were supportive of what was chosen to be taught, complaining occasionally that it was not taught well enough. The textbook usually was seen as the authority on knowledge and the guide to learning. The teacher was seen to be the authority on both social and academic decorum. He or she worked hard to prepare youngsters for tests, subsequent instruction, and the value-orientations of adult life. Though relatively free to depart from district syllabus or community expectation, the teacher seldom exercised either freedom.

Each of the above statements is only partly correct. This summary is a drastic oversimplification of the circumstances observed by the field people and portrayed in the case study reports. The picture at each of the sites--seen through the experienced but singular eyes of our observer--is a special picture, greatly influenced by the administrators, the parents, and the students encountered; colored with technical, professional, economic and social problems. Somehow the pictures do not aggregate across sites to be either the picture of national education represented by the popular press (though no less aggrieved) or that presented in the professional education publication (though no less complicated). It is an interesting collection.

Robert E. Stake
Jack A. Easley, Jr.
Codirectors

LIST OF CASE STUDY SITES

Chapter	Code Name	Description	Field Observer
1	RIVER ACRES	a suburb of Houston	Terry Denny
2	FALL RIVER	a small city in Colorado	Mary Lee Smith
3	ALTE	a suburb of a large Midwestern city	Louis M. Smith
4	BRT	a consolidated district in rural Illinois	Alan Peshkin
5	URBANVILLE	a metropolitan community of the Pacific Northwest	Wayne W. Welch
6	PINE CITY	a rural community in Alabama	Rob Walker
7	WESTERN CITY	a small city in middle California	Rodolfo G. Serrano
8	COLUMBUS	the Columbus, Ohio, school district	James R. Sanders & Daniel L. Stufflebeam
9	ARCHIPOLIS	an Eastern middle seaboard city	Jacquetta Hill-Burnett
10	VORTEX	a small city in Pennsylvania	Gordon Hoke
11	GREATER BOSTON	an urban section in metropolitan Boston	Rob Walker

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CASE STUDIES IN SCIENCE EDUCATION--ROSTER

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Chapter 1

SOME STILL DO: RIVER ACRES, TEXAS

Terry Denny
University of Illinois
Urbana, Illinois

March 1977

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River Acres is a school district serving diverse kinds of "suburbs" of Houston, some of which are old agricultural communities engulfed by the rapid sprawl and others, newly created communities complete with country club and look-alike mail boxes. Itself in a state of tension, due to the absence of an integrating sense of community, this school district has grown and now shrinks a little in response to the unplanned emergence of new senses of community identity. Though barriers of race, language and culture may remain firm for many years to come, River Acres High School and the feeder schools of the district do much to overcome them.

Terry Denny pictures the large-scale dynamics of the River Acres Independent School district with a broad brush, but he sketches in also the fine detail of inter personal interaction and private philosophy. New open-space buildings, older classroom buildings, a drive for success for each child each day, and a strong segregation of pupils by "level" provide a framework in which teachers can teach facts or watch for what's left when facts are forgotten, in which science can be personalized or depersonalized, in which new courses (marine biology) can develop and in which many can declare "We never left the basics." Through all the forest and the trees, a theme emerges that is more Southern and Eastern than Western -- the community cares about young people, teachers embody that caring, and they never shrink from expressing it in one way or another. The picture of mathematics, science, and social studies that emerges is more a picture of teachers than of curriculum, of a culture than of disciplines; but it is very real.

SOME STILL DO: RIVER ACRES, TEXAS

Terry Denny

A GENTLE CRAFT

The reader should know that I have taught in the elementary school and the university over a period of twenty-one years. I also have four children who have completed their high school education in the public schools. I was born and raised in Detroit and have lived most of my adult life in rural/small town university settings in the Midwest.

I am fascinated by what people do in schools and what schools do to people. My task as I saw it was to describe what people said and did about the teaching and learning of science and mathematics from kindergarten through twelfth grade in the River Acres Independent School District, a suburban/rural setting in the Houston area. Not to evaluate it. Not to do anything about it. I once agonized over writing recommendations for schools I had evaluated or researched. Worse, I was nagged with the persisting question, "Was anything ever done? Tell me if anything was ever done." I now rarely write prescriptions for teachers.

The information for this story was gathered on site from October 17, 1976, to December 18, 1976. I listened to 140 teachers and 90 students; over 20 administrators and 60 parents. I also interviewed six counselors and spoke with cooks, janitors, bus drivers and secretaries.

I went to Texas with no personal preference for self-contained classroom instruction, for open-space instruction or for homogeneous grouping of students. Moreover, I am uncertain of the relative social importance of the school subjects as we commonly know them.

It pleases me to write this story without the additional burden of formally judging the merit of the teachers and practice I observed. The fact that I was there and not you is of huge importance, of course.

The Study

Seeing may be believing, but I need more. I never see the picture worth a thousand words. It occurs to me that a very few words can represent a thousand pictures; can represent unobservable feelings; can reveal tomorrow's hopes and yesterday's fears which shape today's actions. My story is largely teachers' words. Students, parents, administrators and others with something to say about River Acres contribute to its telling. But it's mostly a story of and by teachers. It wasn't supposed to turn out this way. The deeper I went, the more I needed a place to park my mind to keep it out of trouble. I found it in the teachers' words.

I began my study by looking at science instruction and then interviewing teachers and students about what they did, why they did it. Hour after hour I saw teachers working, doing what teachers always have done. Students fell into their rightful places, too. Frequently after an observation and interview, a teacher would say something in a few sentences that summed up several hours of observing for me.

Teachers would say their piece, I'd tape it or write it down, and then I'd read it back to them. They'd say, "Hey, that's a good idea. But the parents would never go for it." Or, "That sounds too radical." When I'd say, "I am going to mention it in my report," I heard, "Okay, but don't mention me." The one I liked the best was, "Okay, you be the second Joan of Arc and I'll come behind and beat the drums."

I interviewed teachers in their rooms, hallways and lounges from 7:15 a.m. through 10:00 p.m.; in lobbies of restaurants, dermatologists' offices, and hairdressers' salons; on hall duty, on playground duty, on lunchroom duty or bus duty; before school, during lunch, after school, on Saturday and even on Sunday; at board meetings, and PTO Thanksgiving and Christmas concerts.

After a while I stopped bringing students into rooms for interviews and started talking with them after school; at a basketball game, for example. I put away the project's observation schedule and just "hung around" school. I ended up listening to social studies, science and math teachers talk about themselves, about their own children, their students, their dreams, doubts and dilemmas. In the course of five weeks I filled twenty spiral hip-pocket notebooks. Teachers filled about fifty hours of my cassette tapes. Since then I have read and listened to their words again and again. It is incredible what I hear the second or third time around. My observational notes pale in the strength of their words. So, I shall go with the teachers' words. Res ipsit loquiter, more or less.

Houston

Poet Linda April Raines writes about her city: "In case you missed it, the time to study Houston was now." I feel the same way. Houston caught me by surprise. Nothing I had been told or had read prepared me for what I heard, saw and felt.

You will have to be there to get a larger sense of Raines' poetry, which continues:

> In the melodrama of those
> Fast years
> As the innocents and city
> Slickers entertain each other
> While balancing out the responsibility
> For raising a baby monster

Houston is activity, growth, optimism, in no particular order. Houston is an improbable event: i.e., a sluggish meandering bayou was transformed into a channel to the sea, thereby making Houston a world-class seaport fifty miles from a seashore. The city of today shouldn't have occurred. Infested with mosquitoes, heat, floods, and Indians, a mysterious "will" quite likely made it happen and continues to make it happen. In the nineteenth century, as late as around 1868, the provisional governor of Texas, General Phillip Sheridan, wrote, "If I owned Hell and Texas, I'd rent out Texas and live in Hell." So much for the mid-nineteenth century. In the last seven years, 150 international corporations such as Exxon, Texaco and Shell have moved their headquarters to Houston, our national space center. Space: the final frontier, as Star Trek has taught us.

Houston's population has been doubling each twenty years in this century. Growth is constant. Many demographers say it will be THE city of the late twentieth century. The migration of talent, industry and capital to the South in general and to Houston in particular reminded me of the "high-rolling sixties" in the North. In the lifetime of Billy R. Collom, a child born in the River Acres School District when this study was conducted, Houston may become the world's largest city.

Texas is over 80% urban -- although outsiders consider it rural. The 1970 census revealed only three states have more urban-centered populations (Illinois, New York, California). Houston feels less like a city and more like a huge town to me; much like Detroit did in the thirties, and Los Angeles does today.

I was reminded by the Chamber of Commerce that the first word transmitted to earth from the moon by Apollo II was "Houston." A school board member shook my hand and quickly told me that "We are the energy capital of the United States; the petro-chemical headquarters of the world; the proud possessor of an internationally famous medical complex (achieved in less than twenty-five years)."

Fifty years ago Miss Ima Hogg, daughter of the first native-born governor of Texas, purchased several Kirchner water colors, Pissaro drawings, Toulouse-Lautrec drawings, Modigliani oils and prints by Manet, Cezanne and others (while in Europe in the twenties). For half a century or more, Houston has had its literati.

There is more: from the world's first domed stadium to a first-class symphony, opera and ballet complex. "First," "world-class," "nationally acclaimed" -- frequently used words in Houston and appropriate, for the most part.

The average age of its citizenry is the lowest of any principal city in the United States. That Texas drawl is apt to mask the face of a mover and a shaker. But the immigration is not necessarily politically progressive. Very conservative young Yankees are coming, too. It is a "buyer beware" city. No zoning. Anything the traffic will bear. Futurologists are having a field day with Houston. Forecasts range from King City of the U.S., to a Club of Rome prophecy that "It has seven years until it blows up."

Come rain or come shine Houston basks in a healthy building climate. While builders in other major cities must plan housing starts so their crews are indoors by November, I saw many new starts occur during the last week of my visit (December). Lot and labor shortages are the only problems which appear in the newspapers. The important commodity of money is not in short supply. There appears to be no end to the constant tide of buyers for the new $100,000 homes being erected in suburban Houston. In-migration figures show Texas leading the nation with Houston gaining 60,000 plus per year. Harris County estimates an increase of 35,000 new jobs in 1976 with no sign of tapering off in 1977-78.

Residents enjoy the absence of state and local income taxes and the Texas property tax structure puts it in the bottom 10% of the nation. Add to this the datum that Houston's rate of unemployment was among the nation's lowest in 1976 and continued to be during the time of this study. The economic future is bright for Houston, for Texas.

"Modest" $45-50,000 homes and "luxurious" $100,000-and-up developments--way up--are common. One such, Pecan Grove, reaches for immortality with its soaring ionic-capital marbled columns and its decorative font. Its Texas-sized billboards with golf-course green background and white letters simply state "Incomparable Pecan Grove."

On the north side of a major artery through River Acres graze a herd of Santa Gertrudas cattle; on the south side several hundred technicians are corralled in a modern computer plant. Cabbage and pineapple palms grace school patrons' front yards along with several species of cacti. Other reminders of climate are the inboard/outboard motor boats that dot the neighborhood and the windowless, air-conditioned school buildings.

Proud of its past, optimistic about its future, confident in its ability to get the job done, Houston is something else. When I asked a restaurant owner how Houston was going to manage all this rapid growth he nonchalantly replied "Storms never last." The spirit of Houston sprawls to its suburbs and its schools where Frederic Remington's cowboy paintings and Houston Mission Control pictures share wall space with Lyndon Baines Johnson.

RIVER ACRES INDEPENDENT SCHOOL DISTRICT

Taxes have tripled in five years for some River Acres homeowners. The school district passed a $25 million bond issue two to one in 1975 and looks forward to its next one with confidence. It is building an athletic complex which includes a 10,000 seat stadium. New schools are being built and opened at least annually. The staff in the district is almost exclusively Texan. For example, the high school principal estimates two of his faculty of 161 are from out of Texas.

The problem in River Acres is how to manage growth--not decline. The reader who loses track of this fact will find much of this study unintelligible. The district has 181 square miles and over 13,000 students. It has had the acreage since 1960 when it began its first year of operation, following a 1959 consolidation of smaller districts. Approximate enrollments show the saltatory leaps which have occurred: 1960, 2,500; 1965, 4,000; 1970, 5,000; 1973, 8,000; 1975, 10,000; and 1977, 13,000. Projected figures for 1978 are 15,000; for 1980, 20,000; and for 1984, make a guess!

The student body has shifted rapidly, too. A student body with an Anglo minority and about 25% of its graduates planning to attend a college or university has become a 70% Anglo majority within a student body of which 75% are college bound. A part of the in-migration has been "White flight," a part is urban flight, and others come from Texas communities; and increasingly the district growth is due to corporation transfers of families from other states--principally the North. The first cadre of out-of-Houston "immigrants" to River Acres K-12 will graduate around 1980. Every other week River Acres acquires what amounts to a new classroom of students in the district.

The general increase in enrollment has included an average increase of about 300 minority students annually for the past four years. Lower student achievement for minority students--principally Mexican-American (20%) and Black (10%)--when compared with 10% Anglo students, has been noted over the years at all grade levels. About a third of the students are below grade level in their math or reading achievement scores (1.2 to 5.6 years by the tenth grade); and in this low-achieving group, two in three are minority children. The minority student achievement patterns are accompanied by high dropout rates and a "lack of motivation for traditional and remedial school programs."

There are a few bilingual teachers in a few of the elementary schools. Although I observed a first grade teacher (Anglo) conducted school in Spanish, the district does not have a bilingual education policy. The principal of an elementary school can decide whether or not to offer part of the school program in Spanish.

In spite of its enormous growth, the district manages to stay within the Texas state standards for class size. District schools are categorized as elementary (grades K-5), junior high (6-8) and high schools (9-12). A teacher in an elementary school may have thirty fewer children in grades one and two and no more than thirty-five in grades three through five. In the secondary schools (grades 7-12) there can be no more than thirty-five students in a class and no more than 750 "pupil periods" per week (five periods of thirty students in a class for five days). When these state limits are temporarily exceeded, the River Acres staff seems to roll with the punches, knowing relief is in sight with the imminent opening of another campus. Furthermore, Texas accreditation standards are exceeded in mathematics, social studies and science course offerings grades 7-12. The standards include instructional clock hour minima for grades 7 and 8.

Every urban district in the state of Texas is being redrawn. The move to consolidation of school districts has been arrested. In fact there is a counter[illegible]ing: secession is the word of the day. River Acres is facing the possibility itself, as we shall learn. Two additional omnipresent legal themes are equal opportunity and desegregation. I heard that Region IV, which serves River Acres, may be sued for lack of Black and Mexican-American representation on its board. It has some seventy-odd voting members with one Black representative. (The region provides computer services, audio visual materials and in-service training for its public school district constituents.)

Public library shelves reminded me of where I was: Houston, History of A Giant; Regional Vocabulary of Texas; Barbs, Prongs, Points, Prickers and Stickers (barbed wire); The Cowboy Reader; Sea Shells of the Texas Coast; The Alamo; The Indians of Texas; Indian Fights and Fighters; Texas, A World in Itself; Trails and Trials of a Texas Ranger; 6,000 Miles of Fence (The XIT Ranch); Border Wars of Texas, Lone Star; Texas Ghost Towns; Imperial Texas. Texans from my generation are proud of Texas history.

Emergency textbook shipments are a common occurrence in River Acres. They signal the alleviation of a crisis. A persistent problem is keeping textbooks in the hands of its students. Staffing and space are more obvious problems that are a part of the rush of district life. Some may be getting left behind. An older teacher told me she felt uneasy about the changes underway:

> *I'm proud to have lived in River Acres. It is a very important thing to me to be from here; from Texas. My ancestors helped settle it and my roots run deep. My mother was a teacher. I owe something to somebody else because of my experiences. In a way we have simple values. We value friendship; we want to be easy-going; we like closeness . . . and yes, smallness.*

Before exploring the elementary, junior and senior high schools' science, mathematics and social studies curricula, I choose to present several dimensions which characterize the entire district.

The Administration

Many of the district's top administrators have come to their positions through coaching. Coaching is highly respected work in River Acres. How surprised I was to hear an elementary school administrator greeted, "Good morning, coach!" It occurred again at another elementary school.

Principals joke and are at once serious about their former coaching work.

> *When you get to where you can't coach anymore they make you a principal. And what is wrong with that? Coaches have to have leadership skills, be able to take pressure, be able to work with youngsters; know what it means to not get something worked hard for. Does it seem unreasonable that these are not useful in being an effective principal?*

While former coaches-turned-administrators may joke about their plight, former subject matter specialists often do not. I know four administrators who felt they had made a "mistake" leaving the classroom for whatever their reasons. One telling comment from my notebook says it all: "I used to think of myself as a crackerjack teacher. Now I am a mediocre teacher and a bust as a department head."

For the most part the teachers have no idea who the central staff are or what they do. A teacher of over five years in the district speaks:

> *I really don't know what they do in the district office and I suppose they don't know what I'm doing either. That's the way it has to be in a big district. What will it be like in a few more years, I wonder?*

There are the usual host of petty grievances associated with a school administrative bureaucracy. "Our records are not kept for teaching. They are for show--and who's looking?" A few registered complaints about the sign-in/sign-out daily log sheets which teachers must use. One wag suggested it was proof positive that "Someone from kindergarten teaching finally made it to the top." Other tensions were manifest when a principal observed that: "Our communication with the [land] developers is not perfect. We acquire a site in anticipation of development in one spot, it occurs in another." And a member of the central administration team confided that: "We do have an administrative communication problem where a lot of things happen too late."

A minority but potentially important view of the central administration was voiced by a small group of parents after an elementary school parent-teacher meeting one evening. They felt the district was in control of the "old boys who ran a paternal shop." They said they were actively working toward its demise. I failed to follow up their comments.

Each school I visited had its resident dissident(s). About the only thing they shared in common was their view that the district had an inflated reputation for the quality of its educational services. More often than not the informant(s) had taught in other districts, which may lend some credibility to their observations. Illustrative of their message is the following one which was delivered in a junior high teachers' lounge with several colleagues listening.

> *The district's reputation is excellent and false. It may have been good ten years ago when things were small and close knit. [One old pro nodded in agreement to this.] People may have known one another. The times were better and cooperation may have been high. But that was then. Now the district is literally muddling along with PR-[conscious], not a program-conscious administration.*

At a board of education meeting I watched the superintendent show fingertip knowledge of building construction and production schedules: facts, figures, dividing lines. Precise bus routes required long discussion by the board. "66¢/mile to operate a bus." "1975 bus mileage equivalent to going around the world thirty-two times," one board member calculated. "And they didn't go anywhere," quipped another. "And they're [parents] still mad as hell at us," volunteered a third.

Chairs and seats for the new stadium, field house and buildings were "tested" for ten minutes. Levity, much discussion ensued. After the meeting one instructional staff member said, "It's tangible, football and important stuff. A curricular budget issue would not be tested with as much enthusiasm."

No regular K-12 faculty attended the board meetings. I did. Few, if any, citizens did. Administration and athletic faculty were there. (One thousand citizens at an elementary school PTO and none at the board meeting.)

River Acres, on the move, changing, but still River Acres. Susan Bright could have been describing it for me.

JUNCTION-STREAM

at the corner
of barton creek
and the lower
colorado river
black grackles
haggle over
ginger cinders
and rivermist
longarmed liveoaks
archdown
to the riverbelly
swollen
from flashfloods
water settles
waterholds
the earth together
wind here
clears the spirit,
a soft cloud
blows over austin
renoir city
rain on porcelain
carved a head once
sentry
for the riverwalk
it's gone
wind's glazed
with cooking grease
i feel engines
shake the land
building building
marketplaces expressways
longwords
in autumn
mallards stop here
waterholds
the sky together
waterholds
a man together
met a social scientist
how does it work?
i asked
can you stop it
no he said

Susan Bright

In general, the administration sees itself as being "caught in one hell of a mess, but coping." One senses that "the next building" is always present in the district administrator's mind. They talk about five-year goals while knowing that one year is long-term planning. The management of growth in a setting where everything seems to be changing can be maddening. Seymour Sarason taught us over a decade ago that the paradox of school change is that "The more things change the more they remain the same."

Because they are thin in administrative personnel and virtually barren in curriculum supervision, they look to devising an accountability system that will improve quality control. They look to accountability but some have their personal doubts:

> *Accountability will bring us hell, not help. We need to be working with teachers, not checking on them. After twenty-nine years I come to this: we are, in general, highly defensive, rigid people in education. Compulsive people perceive constructive criticism as personal criticism. It permeates our entire educational system. Education is generally a negative enterprise toward children, toward teachers. It is a highly structured reward structure which emphasizes the negative. Those who get rewarded (teachers and students) are those who make the fewest mistakes. That's how you get to be a successful student, teacher, assistant principal, principal, on up.*

Although accountability is not a large issue among the teachers in River Acres (as yet), there was increasing reference made to it as I went from the elementary to the junior and senior high schools. One junior high teacher was sure "they are going to compare us with Westland with the accountability scheme they're cooking up." Another junior high mathematics teacher was fearful that accountability would mean comparing teachers' successfulness without regard to the instructional levels they were assigned to teach.

> *There is no way to motivate a certain number of kids. They put forth absolutely no effort. I will not be held accountable for teaching an unteachable student. Kids need to learn that if you do nothing you get nothing. . . .*
>
> *Why is accountability the teacher's responsibility? Why is it always my job to solve every problem a child manifests in school? I am not in charge of the math program. So how can I be accountable for it? [When I am assigned the lowest groups] I am not teaching what I could teach best.*

Rules

The concept of the rule is large in River Acres, in Houston. Always be within the law. Don't attack the law, but get it done within the law. River Acres School District is known for its unequivocal policies re student behavior, student discipline. The faculty are generally very appreciative of the policy, as are the parents whom I met. The district is not beset by student use of dope or booze; nor is vandalism a problem. Windows are in place, student toilets are clean and hallway speech is remarkably free of the language of the streets. "Only paddling on the buttocks with a paddle . . ." was adopted by board of education, July 1974, as a part of the board's behavioral policy.

The Parents' Handbook pleases many when it says under "Unwritten Regulations":

> *Each year there are a few distracting things including some "fads" that show up on our campus. We are not listing any of these nor are we making a regulation to cover all problems that may arise. When any "fad" gets started on our campus*

> *and a "nuisance" develops, we shall immediately eliminate that nuisance. ANYTHING THAT DETRACTS FROM THE SPIRIT OR DIGNITY OF RIVER ACRES SCHOOLS WILL BE CONTROLLED.*

Planning

River Acres believes in its ability to provide good schools for most of its children. It believes it will weather the currently deeply felt growing pains. It also believes that to achieve these and other school ends it must be better organized. Its schools are large, roughly 1,000 in an elementary building, 1,500 in a junior high, 3,000 in its high school. Better organization is going to result in better schooling and the role of planning is central in the minds of its district officials. One effort which is meeting with mixed success is an attempt to get written descriptions of its science, math and social studies curricula in an orderly fashion. Curriculum guides have been developed by personnel working after the school day and after the school year. In its attempt to use a uniform format for spelling out objectives, activities, and evaluation in these guides, the district has met with foot dragging and considerable latent hostility by teachers who see no use for such efforts. An overwhelming number of the teachers see them as, at best, irrelevant to their work. One fifth grade teacher said, "I wrote my way to a [master's] degree using those behavioral objectives and I haven't had a mind to touch one since."

The importance of planning is also stressed in the district's Faculty Handbook.

> *When days go badly, check to determine whether your plans were adequate. Chances are they were not.*
>
> *The Program. (first item) "Have the instructional program so carefully planned that there is not time for major problems to develop. Account for each minute of the day in your plans."*

For all the talk about planning at the district level, the facts are that River Acres pretty well runs itself educationally at a building-by-building level. Some love it, most accept it, some disparage this condition. One principal offered a prescription for changing the district confederacy to a more centralized educational program.

> *You want to know why I'm boss here? I'll tell you why I'm boss here. Because I have authority. You need coordinators [at the district level] with real clout if you want an integrated, funnelling program. You need people with authority, not with "supervisory" capacity. That's the way things get done in Texas. Until that happens each principal will run their [sic] own school the way he wants to. When the Associate Superintendent speaks, we do it. The others muddy the waters.*

Planning can be attractive to teachers, too. Not so much as a district-wide strategy, but moreso at the building level, and especially in the individual classroom. River Acres teachers perceive their largest needs as being instructional materials and tactics for grabbing and holding students' interest, thereby minimizing discipline problems. Whenever planning addresses these concerns, it generates teacher interest. The teachers who had experienced NSF support were unanimously high in their praise of their experience and called for more.

> *The NSF should continue to support subject matter institutes in the summer for teachers who want to change what they are teaching. There's no substitute for knowing the subject matter of what you're teaching. It took me eight summers to learn earth science--plus four field trips to the same place before I really felt comfortable with geology.*

Parents

The attendance at school meetings and social functions is outstanding. Nearly 2000 parents attended a spring physical education open house in 1976. During my visit I attended several parent-teacher evening presentations, each of which was heavily attended by hundreds of parents. This was in sharp contrast to the two school board meetings attended by a handful of citizens. I must note in passing that during my study a small city within the district was organizing to secede from the district to form their own. A special election was held and the secession was approved. The issues were not discussed in the papers nor at the board of education meetings. The matter of citizen involvement in the politics of the schools remains a puzzlement to me. I overheard a coffee break comment by a central administrator that "parent involvement makes district administrators very nervous."

Parent involvement in the direct schooling of their children is large. There is pressure on teachers to succeed. The citizens expect it. They communicate it through complaints about their children's grades, in their doubts about open space instructional environments. Parents of junior high school students said very little to me about their expectations of the high school. They sensed that its reputation was good. This is noteworthy in that some spoke at length, with negative feelings based primarily on hearsay information, about the district's elementary schools, which their children also had not attended. The district administration corroborated my impression that a vast majority of its patrons' school concerns dwell on the elementary and junior high schools.

Teach and Student Evaluation

The district requires an administrator to evaluate each teacher. It has a five-page form with opportunity for the teacher and principal to make parallel ratings of the teacher's competence in four areas: personal and professional qualities, classroom management and instructional effectiveness. No mention is made of student achievement or grades or use of instructional materials per se. "Keeps accurate and meaningful records," is one of several points itemized.

Several teachers called for in-service help in working with teams, with open space, too. Meeting this apparent need would present problems for the district, though, in that the high school is predominantly against the concept of open space and one elementary school prefers the self-contained classroom arrangement. These are not burning issues because teachers are not evaluated on their ability to work in an open space setting, or their success as team-teaching members. Nevertheless, there is rather widespread dissatisfaction with the form and the process employed. Administrators are charged with not having visited the class. And the criteria are ambiguous in some teachers' eyes: "Who am I being judged against, God? The poorest teacher in the building? How about judging my competency against the competency of my administrator? As long as we're at it, how about a parent competency test?"

The district in-service program is a modest one. It does not address the major issues brought forward in this study. Again and again teachers new to the profession commented on their dismay when the "paperwork of teaching" confronted them: the forms, legal and administrative record keeping. Further, the concept of a district, how it operates financially, administratively and legally, is pretty much a mystery to the neophyte teachers in River Acres. They are often surprised to find how fine grained the grading system is.

A district-wide grading policy is in effect:

100 - 93	A
92 - 85	B
84 - 77	C
76 - 70	D
69 - 00	F

It has its detractors and there is a small minority of elementary teachers who would abolish grades completely: "We have to. It's our policy. I'm against them. Social promotion means a child should be provided for. A good society would promote good education for all children." For the most part, though, teachers and parents find the grading policy and practice to their liking. Notable exceptions, when grading creates problems in the context of achievement or ability grouping, will be discussed later on. These center on teachers feeling pressure from administrators to award high grades, to flunk no one.

Open Space

Open space is a K-12 issue in River Acres among teachers, parents, administrators, and students. Six of the seven elementary schools are "open space" in architectural design. The seventh is not--nor does its staff want it to be. Advocates of open space schools believe it results in improved planning and teaching.

> *Open space gives you the option of building in space for those who cannot function in open space. [In the self-contained classroom] there is no option for the kids who cannot stay in the room except another room, which is no option at all. Where we usually find problem children in self-contained is in the hallway on a chair--if we're lucky. There are far fewer kids who are sent outside the open space.*

Open space in River Acres elementary schools and in both its junior high school buildings means they have large areas in which the instructional space can be organized as the responsible parties see fit. Instead of eight rooms each with its own entrance and teacher, let's say, we have an enormous area without permanent walls, doors. This area may be used for all sections of a grade (or two) in an elementary building. In the case of the junior high school it can be used for all mathematics teaching, with the students of the three grades moving in and out throughout the day.

Aspects of open space and self-contained settings which are seen to affect science instruction will be discussed. The district administration is committed to open space at present for K-8th grades. Because of the recent rapid and considerable growth in River Acres, most of its school buildings are new. Yet, although its new buildings are all open space, there has been little time to train teachers to work in such a setting, and few teacher education institutions offer elementary teacher candidates help in readying themselves to work in math and science, much less in open space settings.

Each River Acres school is graced with a library and a resource center, which are intended to support the open space concept. Mathematics teachers make little use of these facilities at any grade level throughout the curriculum. Only the odd child will be doing something in them that relates directly to mathematics. For the science curriculum the picture changes somewhat, but not dramatically. A child may have an occasional assignment, but the principal user in science is the teacher of grades four through seven. Before and after those grades, the teacher's use is limited to getting a desired film strip or sound film from the resource center. (A multi-district regional center is the principal supplier of the non-print materials used by science and math teachers.) In the social studies the use of film is considerable by both students and teachers, but I found no patterns of use that could be called exceptionally heavy or inappropriate. (On rare occasion I heard something akin to "I have some India films--does anybody need a film today or tomorrow?") The junior high schools' lush resource and library facilities were without students most of the time I visited.

> *Classroom teachers know far better than do librarians what resource centers need. That's why you will find lovely facilities not in use; the teachers are not a part of them. The day of the study hall is passing and we don't need these grand facilities just to keep kids busy and quiet, or to get the group size down. We need to get materials kids can use and librarians don't have to guard with their lives.*

Open space can provide opportunities for scheduling flexibility, for team teaching, for cross-grade instruction and the like. Whether it does (or should) is the underlying issue in the minds of many River Acres informants. They will speak for themselves shortly.

Preparation

The spirit of the Samurai is in River Acres schools. If you prefer Parsifal, the Boy Scouts, or Galahad, so be it. Teachers see their science teaching as getting youngsters ready. Preparation for the next grade, preparation for the more difficult courses to come, preparation for college entrance. For life. "If you're prepared, you can take anything life dishes out to you. Getting right with life involves good preparation," one assistant principal offered as the key to elementary school, and more.

One high school science teacher (who has taught math) spoke to preparation with considerable animation.

> *I'll be frank with you. A majority of my students over the past four years are not prepared. They cannot study. They cannot read a mathematics textbook. Their science an chemistry lab reports are generally awful. I have not been pleased with myself this year at all throughout my chemistry courses. When students aren't prepared you are dead. So I fall into doing it for them.*
>
> *Perhaps my materials is too hard? [Offered to have me review it.] My thought is that students today lack the feeling of coming to class prepared; of being responsible for doing good work.*
>
> *Preparation will improve on the student's part if you let them work in pairs. Performance improves dramatically when my 3's [below average] work together. Girls especially "tell" you how they want it [just by looking at them] walking down the hall. They won't even walk from one class to another alone.*

The basics in math prepare one for advanced mathematics; writing and reading skills prepare one for literature and the social studies courses to come. Trigonometry and physics prepare students for their college experience and high school prepares them for whatever follows. Nowhere in the K-12 curriculum do teachers concern themselves with preparation more than in the junior high school.

> *This is it boy; if they don't get it now, they never will! This is the last chance. If they blow it here they are dead ducks. They just have to be prepared for high school or that's all she wrote. There's no turning back, or slowing down a little, or backfilling up there. My job is to help these little buzzards to realize that [the importance of preparation] before it is too late. I get to some, miss others. God knows I try.*

That mathematics teacher spoke for many, many others in the sciences and social studies as well. She works hard at trying to prepare her students and by her own admission is not making progress as the years go by. It is a hit and miss proposition. But the target is clear. In River Acres the junior high school curriculum arrow points in one direction: to Central High School. What the students have been getting ready for is variously described as "the big crunch, algebra"; "where many of the Latin [Mexican-American] students will meet their Alamo"; "the Rites of Academic Passage [re college]"; and, "the end of preparation and the beginning of the real thing."

Eighth-grade students often described it in social rather than academic terms. They see it as, "When you gotta do it, or quit and get a job"; "Where you meet new friends, dates, and sports"; and the time when "I finally get wheels."

Competition

A discussion of the utility of competition as a pedagogical tactic is presented now because it is a K-12 River Acres issue, and it might as well be introduced early as later in the story. I found increasing advocacy for the use of competition as I went up the grades and up the instructional levels. One administrator offered:

> *Competition is great for kids when everybody knows the rules. When competitors can accept their limitations. If I could, I'd eliminate competition in the early grades. . . . I think competition is the most overemphasized thing in athletics and I am a former coach. If [principal] Adams would transfer his energy and coaching perspective to instruction instead of kids and PR, he would be an outstanding instructional leader.*

Another administrator countered:

> *Competition makes the world go around and kids stay on the ball. It is one of the few things we have left that works. If you took competition out of it [the curriculum] you would have downright chaos. Or sleep. We lost our fire for healthy competition because of some mental hygiene theories. So we took it out and put nothing in its place. A terrible mistake. Teachers and parents are too damn concerned with whether the students like them. If that is what is really important to us, we had better get out. Because they [students] will use and abuse that. They know. Like a little blood in the chicken yard. What we need is teachers who like kids, like their subject, teach it like hell's fire and don't give a hoot about whether the kids like them. Competition is good; I guarantee you that. Put that in your notebook under "old-fashioned ideas."*

These are extreme positions to be sure. Most informants said nothing so extreme about competition. But it was mentioned often and employed widely. Competition represents a background dynamic operating in these schools be they open space or self-contained.

A New Crop

A viewpoint which holds widespread allegiance among River Acres' elementary teachers avers the increase of behavioral problems in young children. Some call them "rowdy," "hyperactive." Others use no labels, but point to a 10% figure of early primary children now on medication as cause for concern. "These newcomers are brighter, all right, and they are more difficult, too," offered an experienced teacher after a particularly difficult day. Another said:

> *Slower kids are getting harder to handle. Slower kids from the wealthy homes are the worst. Not a matter of social class at all. It goes beyond Westland Junior High and this elementary school; beyond Houston. And a new element has really taken hold. Children who are plenty bright enough just do not pay attention. I cannot recall seeing them in such numbers. Finally, the number of children on medication, the hyperactive, is considerable. Every class in this building has children on medication. This has been going on for seven, eight, nine years.*

Teachers' comments are not restricted to the bright or slower children:

> *I am mostly concerned with the average kids who have it and can't get it together. Mother will make excuses for her children not finishing anything. They are just left to grow up in life alone, in their rooms, or with the "tube." They don't even have the streets or gangs to teach them. They just wander. Everything is prepackaged for them. They are so bored, so young.*

A district administrator with elementary school teaching experience suggested:

> *The average student is the one who is getting along, not bothering us, not flunking, and not creating problems for us or the principal. That's what the average student is, and that's the one we quickly forget. There are so many others who do bother us. Their classmates, [who] are not learning, and are driving their mommas and daddys crazy, that we have to pay attention to.*

There's a new crop of parents, too, and the demands they will make on teachers in River Acres are now just being felt. One young mother, born, reared and educated in the East, almost got up on a chair after a PTO meeting to deliver the following lecture for my benefit.

> *Homework that is busy work is trash. Teachers wonder why I don't ask my child to finish it? I don't think it is worth doing, that is why. I want my kid to grow up to be a sociable human being. Every night of the week I have at least two or three things my child could be doing that clearly would give her skills, new experiences, a chance to grow in social and intellectual maturity.*
>
> *When one of the "choices" [long drawl] is some dumb cut-and-paste project or eighteen somethings she clearly already knows how to do, or putting together something that nobody in the world in his right mind could care about--that loses to the more important things.*
>
> *I don't want to minimize the problem. I just hate not supporting homework, the teacher; but when it comes down to doing a silly geography cut-and-paste-the-rivers project and attending the Houston symphony, my daughter will go to school humming Chopin the next morning.*

Teachers are unsure how important these matters are for the future of River Acres. Some believe most primary-school medication problems naturally stop by the end of middle childhood. Others feel that child unrest is national in origin and will change "as our nation returns to peace and prosperity." A few elementary teachers and principals think a source of the new crop problem is becoming too difficult too early. As one fourth grade teacher said,

> *We are pushing too much downward. Fifth-grade cloud formations [science] I learned in high school. A child is required to learn things at the introductory level forever [because we start too early]. The teacher who follows the math manual is inadequate in many ways. I am still teaching the same things to my fourth graders that I did in the first grade.*

A principal at another building saw the 1970 sixth-grade curriculum as now being the 1977 fifth-grade because of River Acres' sixth-through-eighth-grade junior high school arrangement.

An elementary school staff member poignantly expressed her sense of the changing times and the changing children of River Acres:

> *We are going to have to leave the "mother hen" concept in education pretty soon. Kids in the future may move from a resource center to home to other non-school learning environments during the course of a school day. We will never go back to the small community with the insultated school where no one pushed too hard. We wish we could reach back to when 10% of our kids in elementary school weren't on Ritalin and God knows how many of their teachers are on Darvon. We wish we were smaller again. But you see when we were smaller, and I was here, we were not better, we were not more person to person, we had a hickory stick and not much more.*
>
> *The bright kiddos have always learned. We could get away with saying, "You can't do that" and make it stick. I miss that part of it. But we must reach out for something better. We are reaching back to when the purpose of school was clear; when there was time to finish. That's what gets the teachers the most: it's either no time to finish or no help in using the time available when nothing seems to work.*
>
> *It's all starting just about now. We are going to see some teachers crack around here in the years ahead because no one is looking ahead on these things I'm talking about.*

The recent past, present and foreseeable future of River Acres schools will feature student grouping for instruction, the last general topic to be described before turning to the elementary schools.

Instructional Levels

Students are grouped for instruction in mathematics from first grade through high school. In the elementary grades children are grouped for reading as well. In junior and senior high school the students are grouped in science and social studies, too. By the senior year of high school there is an enormous difference between the top group and the second and third groups. Another sizable ability/achievement gap occurs between the third and fourth groups. It takes an exceptionally talented and dedicated student to do top group work in all subjects at Central High School, according to students, teachers and parents. Level one never comprises more than five percent of the class and is often less than that. During the period of this study the high school mathematics "major works" program, as it is called, had between one and two percent of the students in it. (There was no major works program available in social studies beyond a group of twelve students in a highly specialized courses.)

It would be difficult to overestimate the necessity for instructional levels in the minds of many of the teachers, administrators and parents. I discovered early that the most commonly used term is "level"--although some elementary teachers will talk about instructional "blocks" when discussing grouping. (Word labels are important to some. One teacher told me, "Get one thing straight, we have levels, not tracks"! Later in the study an administrator said to use the word "corrective" not "remedial." And the "self-contained" classroom teacher said not to use the word "traditional.")

The Elementary Faculty Handbook spells out district policy on grouping:

> *Heterogeneous grouping is encouraged for all subjects with exception of mathematics and language arts.*
>
> - *The achievement level groups are based and organized primarily on the effectiveness of the pupils' reading and math skills.*
> - *Teacher-evaluation, the supporting cumulative reading records, and achievement test scores will be the guidelines in setting up classes.*
> - *Cumulative Reading Record cards of skills and enrichment materials will enable the teacher to diagnose needs, deficiencies, or problems and adapt instruction accordingly.*

The lowest instructional level in elementary school often has special education students in it, too. It is not clear how well this is working.

> *"Special Education" is a word we use for kids that are really pretty smart quite often; in fact, a lot have normal or better intelligence if we tested them differently. They may not hear or see things the way "we normal" people do. We say they "perceive improperly." Sometimes it's three or four little things that we say add up to a school problem for these kids. Still others think very well, very well--but slowly. And everyone knows [sardonic intonation] that you can't think slowly and be bright, right? Still others have times when they simply cannot concentrate, and so on. They really do differ but we call them all special education--or poor students.*

A second grade teacher sees grouping children by levels contributing positively to the slow learner. "Because the slow student [sic] can do the work they see they can be proud of themselves. These kids are getting 80s and 90s [grades] in science class."

Other techniques are used to aid instruction by levels. The elementary schools make use of short-term contracts in which the student has a specified number of pages to read, questions to answer and suggested activities to perform. Also, packets of materials have been developed in several subject areas, elementary science being one. They are used by teachers to allow students to work independently while the teacher instructs a group. An enthusiastic user of packets described them:

> *Remediation can be one-to-one if you have packets. And extra work to keep kids busy is always there. Kids can work in teams. Each kid turns in an activity card to the teacher to be checked. [For math and reading.] We date each time we check. The record of dates when work is complete has proved to be a boon to us. It lets us see who has been goofing off--when there is a lapse of time and no work has been turned in.*

A former teacher now an administrator had reservations about contracts:

> *I am not sure of the success of them. The kids go through the motions but I am sure they miss a lot. Used mostly with upper level kids. Lower level [children] are all teacher directed. We begin in fourth-grade science and somewhat in math. In fifth-grade science, social studies and math we use them. It takes a lot of teacher time to prepare contracts. Teacher-made materials are required.*

A very few elementary teachers are not convinced that River Acres' levels, contracts, packets, and subject departmentalization is the way to run a school. One principal said that most teachers saw that departmentalization improves getting the best subject matter specialists teaching the most kids. "But [some] see it as an issue of kids versus subject matter. It is both a blessing and a curse. Teachers need to be with their chicks, and vice-versa, chicks need good feed to grow." A teacher in another school agrees: "A good self esteem is more important than achievement test scores, and when you departmentalize you throw away your chance to work closely with youngsters."

River Acres could be counted on to have its articulate dissenters as well as its enthusiastic supporters. A discussion of grouping and levels drew one contrary administrator out:

> *Dumbest idea ever perpetrated on schools. Fewer levels are better levels. The idea of a level is stagnation for starters. There is no such thing as a level. There are adults who need to figure out some way to meet the challenge of different kids. So, we invent the idea of a level. Pretty soon we say it enough that it becomes real. We could have invented learner "types" or "behavior patterns" or whatever and sorted kids out that way. We'd very soon believe in that, too. What we have to get around to here pretty soon is what good are these ideas, levels, and can we show that they serve anything more than teacher convenience.*

A teacher with more than twenty years in Texas schools sees educational grouping principally as a product of school integration efforts:

> *I'm not really for grouping. Grouping in Texas was done only for segregation. That's the year it came and that is why it persists. They can talk all the fancy talk they want to but that's why grouping happened and that's why it's here [in Texas]. This district is probably one of the few exceptions in the state. [Instructional levels are not intended as a segregation tactic.] I've worked with our state professional organizations on this matter and it's common knowledge among them.*

Another administrator of many years' experience caught me unawares when I asked for some reminiscences on the good old days she had seen. We had been talking about the increasing complexity of schooling: contracts, packets, levels, special education, litigation, whatever. She had leveled harsh criticism at much of our "modern adjustments" to school problems.

> *The old ways are a bunch of baloney. I can teach prepositional phrases with Glenn Campbell's records. The times oblige us to teach with an eye toward entertaining children. TV and current events make us have to change with the times. We have to use methods and techniques that work and not stick to things that once worked. Any recreational road to instruction is useful as I see it. The whole concept is molding minds. We must approach the task with flexibility. We must work with children, not against them. The subject of the elementary school is children, not math or science. When subjects are focused on, it then becomes which level to teach. Now every teacher knows from kindergarten through high school that the top level kids learn in spite of you. They teach themselves. So we all want them. We can teach all that good stuff almost by throwing the book in the room from the hall.*
>
> *High achievers learn in spite of you--that's what high achiever means: he has gotten more than what has been offered on the average. The easiest thing in the world to teach is subject matter. That means the kid is ready and able. The fact is that by the end of our school most of our kids aren't ready or able for most of our instruction; they have dropped out, drifted down to the bottom groups or are doing badly in the top ones. I defy anyone to look at a thousand children in RAISD and prove me otherwise. Now the hell of it is we are no different from any other school district. I'm only being honest about it.*

Pretty strong opinion there. Which brings me to the elementary schools and a topic on which there was more agreement than any other in River Acres.

THE ELEMENTARY SCHOOLS

Back to the Basics: Near Consensus

"Good thing" was the nearly unanimous response to my question on the topic of "back to the basics." One teacher captured the prevailing spirit of River Acres when she said, "Back? We never left!"

The meaning of "back to the basics" for science and social studies teachers throughout the grades is increasing reading skills of children in the elementary grades. For math teachers K-12 means learning the 100 basic facts in each of the four arithmetic operations.

There was one exception to this near unanimity of viewpoint. As a key administrator in the district, Mr. Shores surprised me with a discussion of achievement testing, which led to the purposes of schooling and what was basic to it:

> *The quality of student that has been entering our district of late makes us look very good in achievement. If all we did was look at our achievement scores we might as well all go fishing. Sixty percent of our students are above the national norms and half of them moved in since 1970.*
>
> *This creates a very interesting problem. Even though we are organized on a basic skills type program--at least through the eighth grade--I feel most people would prefer that their child be a useful happy citizen who knows how to get along with other people. We are all hung up on back to the basics and aren't dealing with the problem of the development of the child very much. The ultimate goal is for the child to feel positive about himself.*
>
> *In the elementary school we have tried to instill in our teachers that each child experience some success each day. So from kindergarten through five [fifth grade] we emphasize growth of self; from six through eight, the understanding of self with others; and from grades nine through twelve, competition with others. You don't have to emphasize the basics in elementary school. Every child wants to go to school. There are no six year old goof-offs--they want to do the best job they can. In high school kids nearly have to be made to do everything they do. Fear, college requirements, punishment, grades [are used]. Then we say, "These kids don't want to learn. Look--their basic skills are just awful! Look at that spelling! And they don't even want to read! Let's get back to the basics!" I feel we need to emphasize the child more and the basic skill less. When the child is experiencing success he'll get those basic skills as best he can.*

Open Space

"Closest thing to a marriage," said an administrator of her open-space school. She and many others who advocate open space see a chief benefit in the opportunity for two or more teachers to act as an instructional team. The marriage metaphor is apt in that many of the interpersonal joys and pains of marriage were easily seen in the open space schools. Some open space teams were really humming, some were having their problems--a few were "on the rocks." Texas accreditation standards define a "self contained" class as one taught by one teacher for fifty per cent or more of the school day. Open space is not defined. A district administrator pointed to staff selection as one key to success in open space.

> *The ability of teachers to get along with children or adults in any setting is magnified by the open space. This ability is not a part of our staff selection criteria or the teachers' education programs.*

A self-contained teacher who had not taught in open space commented on team teaching:

> *It must occur there more easily than it does here. We do it, but it is tricky to schedule. More minds are better than one mind. That has to be an advantage for open space.*

The management requirements of open space were emphasized by a district administrator:

> *Our commitment to open space requires more management than would self-contained. The team leader is crucial in open space and team cooperation can become an issue. In self-contained it is the principal's word against the teacher. In open space it is possible for a sizable group of adults to be involved in an issue about responsibility. The role of the counselor in open space is preventative. In self-contained it is remedial. I'm not sure that the counselors realize this.*

Open space in River Acres also involves team or grade-level scheduling. In self-contained classrooms a teacher can plan and adjust the schedule to her individual taste. Not so for open space. The benefits and problems were candidly described in words that squared with my observations:

> *Open space means large bays with 120, 150, 180 students. The first few weeks of school are difficult--getting to know the names of children, their personalities, their medication and other special needs.*

An issue-packed balanced statement on open space was provided by a principal.

> *Scheduling is at the heart of the matter. Grouping requires that schedules be followed. So while it cramps your instructional time it assures you of [curricular] coverage. Self-contained allows the teacher to use her time flexibly, if unwisely. Open-space programs [assure] wide coverage and lost opportunity to stretch out a lesson when needed--to cut short when it seems wise to do so. When a lesson is going well in open space and the schedule "speaks," that's it--in self-contained you keep rolling.*

A third grade open space teacher argued.

> *The schedule defeats it. The lower groups are hurt the most by the schedule. They are "turned on" so rarely and it would be good to [be able to] go [on teaching] when they are. But the bell rings.*

Another upper grade teacher said that open space was "perfect for some of my remedial children. They need to move about. But the schedule is working against us." She asserted that more than one period is needed to "really pick up the child who is way behind in reading or mathematics."

The district's Handbook for Parents presents several reasons for its open space building program. Two are:

> *Greater efficiency in personnel utilization which lowers student-adult ratio and allows for more realistic individualized instruction . . .*
>
> *Total staff growth is obviously a part of team teaching. Teachers working and teaching together pick up "tricks of the trade" from one another.*

At the very time when many districts across the nation are "phasing out" open area schools, River Acres is building them as quickly as they are able. The board sees a savings in construction costs and some administrators see an opportunity to change traditional patterns of instruction. One spoke at length on the concept:

> *I get discouraged when professionals emotionally knock something they have not seen, don't understand and won't make the effort to know.*
>
> *I have been in a crackerbox traditional school that was run beautifully under the open concept and have seen [architecturally] beautiful open-space schools run as though all classes were self-contained.*
>
> *If I were teaching in the high school and were satisfied with my work, why would I want to change to open space? I would feel uneasy about other adults observing me daily. What about those "you-let-me-alone-and-I'll-let-you-alone-days" that you can hide in the self-contained classroom?*

Even the most enthusiastic supporters of the open concept agree it takes considerably subtle structure, particularly in the expectations children, parents and teachers have of it. A principal who claimed open space gave her a chance to move children more easily from one level and one class to another also said:

> *Open space takes the very best by all of us. You, parents, colleagues, whomever can see all of us--no matter who you are visiting. When a person comes to visit one teacher all of us are subject to review. Toes do get stepped on. In open space, flexibility is the key. A couple teams almost destroyed themselves. The first question I get from a parent, a new teacher, a visitor is the achievement question. Do their scores stay the same? Drop? [In reading and math, of course.]*

Open-space teachers were remembered by a self-contained classroom teacher who decided not to move to an open-space school.

> *They erect their little divisional barriers, then cubicle off their own instructional space, then color-code their levels, then get their desk right where it used to be in self-contained. Once that is done they are ready to be open.*

Another self-contained classroom enthusiast saw it this way:

> *There just are not profoundly different pedagogical approaches going on in open space and self-contained. What is going on is a slavish adherence to the schedule and a failure to consider the importance of distraction as a problem for young learners. By distraction I do not mean solely oral distraction or the noise! I also mean something a little more subtle, visual distraction. When your friend in another class in open space gets up or gets yelled at, that's distraction.*

And a prophecy was offered by a teacher who had taught in both arrangements:

> *The bright kids will do well or even better in open space. For the average it is a maybe situation. For the slow it is a disaster.*

A second-grade teacher missed "her kind of sounds" when she visited an open-space school:

> *It is reminiscent, faintly, of the one-room schoolhouse with its grades all together . . . yet separate. There's no singing in open space. And laughter must be kept down, too. Think about that. When you sing in open space you have to bother the others. While it doesn't happen very often it is important to be able to go out and read under the pecan tree when the right moment arrives.*

Another teacher (fifth grade) who was positive toward open space reported parental resistance:

> *"Sit-down-and-be-quiet" parents can be counted on not to like open concept. It is interesting to see how the child who may be hurt by open concept usually has the parent who never shows up.*

The parents I spoke with at several parent-teacher night meetings were over-whelmingly in favor of the organizational arrangement their child was in: self-contained or open space. (I did not find parents with children in both settings.)

> *Someone is teaching my daughter a lot of good astronomy. She eats it up.*
> *I am amazed at what she is learning in the second grade.*
> *(He is an electrical engineer.) (Northerner)*

> *My son was behind in his basics in arithmetic. The teacher helped us, recommended flash cards. It was a long last year, but he has caught up now. I think the math program is terrific.*
> *(Texan)*

For many who teach in open space the appropriateness of the concept is a matter of the needs of the child. A winner of the district's award for excellent teaching said:

> *Self-contained versus open concept is a question of the child. In general open space suits far more elementary children then it does not. Distractable learners need self-contained classrooms. If the child is suited for open space it means I can do much more with him. The big difference for me is the goldfish bowl. There is no place for me to goof off--to be lazy.*

A claimed, long-term benefit of open-space instruction is that more science and social studies instruction takes place. The teacher cannot delete one or the other from her schedule because she wants to teach more reading (or whatever), as she can in the self-contained classroom.

An unusually strong claim for open-space education came from an administrator of many years in the district.

> *We really believe in the potential of open education. By stressing individualized instruction you get what we all want: the basics taught, each child gets his individual liberty guaranteed and the slowest and best child get their chances to move forward. Individualized instruction can really be what America needs in these troubled times. Good programs and good materials can meet individual needs beyond the most fantastic dreams of any educator.*

Those who regarded open space as success could see historical relationships between it and their teaching specialty. The physical education teacher suggested:

> *If you think about it, PE teachers have always had it. They have combined classes, broken classes down for skill training, ability grouped where necessary. PE teachers get such a bad rap from the academic teachers that they probably couldn't admit it.*

And a kindergarten teacher reminded me that pre-school and kindergarten teachers have long embraced the open space concept.

Other reasons which underlay support included the teacher's need for activity and working with others:

> *I love it. I am an active person. I love to work with others. I'll say for certain I'll never go back to teaching self-contained. The ideas of three others [teachers] are almost always an improvement on mine alone when it comes to teaching. But I will say thirty-minute blocks are not enough.*

I met with a group of four elementary teachers who provided this summary statement:

> *We have so many things going on here. We can see more progress here [open space] as teachers. [All could compare with self-contained, direct experience.] Problem is individualization is restricted in self-contained room. If you think noise is a problem or distraction is a problem out here, try to do more than one thing that is noisy in a self-contained room. Here we can learn from another teacher; the child can and does, too. [We] can see what others are doing. "Am I getting it across as well as she?" It's a lot more helpful than hurting. Sharing ideas. We have weekly team meetings as a primary team. And it is no big deal to walk in. Others can help you when you need to go off for a brief period. The people who invented self-contained classrooms think teachers have twenty gallon reserve bladders.*

A primary team leader has watched her second graders become fifth graders in her school's open space setting and is extremely pleased with them and the arrangement. "I go over to them and tell them how proud I am of them. Don't let me down," she said. Two other teachers in that school come over to the lower grades and tell them they "can hardly wait to be with them next year." Another class of second graders has been over to "meet the third grade section" and to talk about what it is like.

Two teachers new to open space are not convinced:

> *If you'll look carefully at our open space elementary schools you will find close, self-contained classes set in a large, open area. Parents, too, want close, personal contacts between teacher and child, especially at the early years in elementary school. "Little people need a central person to call their own." Teachers in both settings in the elementary schools say, "We are teaching basic facts in arithmetic, doing experiments in science." Both use activity packets, contracts which call for a certain amount of work on the child's part. Both emphasize pacing, grouping by level for arithmetic, very sporadically in science and never in the social studies.*

For what they are worth I noted:

1. Open-space teachers appear to be on their feet more than are self-contained classroom teachers;
2. Teachers in self-contained appear to make more use of chalkboards;
3. There is more noise in open space than in self-contained rooms;
4. There is more student movement in open space.

I asked teachers about student freedom to move within their area. In one school a teacher said open space has long been a traditional idea in kindergarten.

> *Now it continues in the first couple grades. Children are free to walk around if they don't bother their neighbor. Bang, comes the third grade! [And less of that freedom.]*

It is difficult to avert certain distractions in open space settings. For example, when a first grade class files by silently (from lunch, let's say), the class in session can largely be involved in smiling and waving at friends.

By the fifth grade the children are used to open-space buildings. One elementary school holds fifth grade town meetings on Friday. "Onions and roses" are handed out to kids and staff. New students are introduced--a less than obvious but very important function in a quickly growing district. Problems are aired. No complaints are registered from other grades about the noise or laughter emanating from these meetings.

The Elementary Faculty Handbook addresses the problem directly as one point in a list of "DON'TS."

> *Do not talk through noise. One of the most common mistakes made by teachers is that of competing with a "room full" of noisy students. At the very outset the teacher should make it clear that he will give everyone who has anything to say an opportunity, but that he expects the same consideration. Then, if he refuses to compete, if he will stop and wait for the offenders to give their attention, the habit of giving respect to the person speaking is soon established. If the teacher does compete, however, another kind of habit is formed; more people get into the competition, the volume of noise increases, and the control problem is immense.*

The matter of noise in an open-space school is a lively topic in the district. The chief complainants about the noise in elementary school are those who have not experienced it directly as a teacher. The adverse comments were quite rare from those who taught in open space. Later in this story we will note a shift in these attitudes in the junior high schools.

All in all, those in open space advocate it. (This is less true for junior high teachers). Self-contained classroom teachers advocate that arrangement. Neither marshal convincing arguments that it makes any discernible difference in what children learn about science, mathematics or social studies.

Elementary Science

Elementary teachers in River Acres believe formal science instruction is necessary in the early grades. I asked many what difference it would make if they delayed the formal teaching of science until junior high school. Nearly all felt that would be unwise. That children would not be prepared for junior high science was a commonly anticipated consequence of such a curricular exclusion. This is particularly noteworthy when one considers that almost none knew what was being taught in junior high school. Later a similar point will be made for the junior high teachers.

What's The Big Idea?

As was my wont in mathematics, I also asked teachers what science was or "What is the big idea?" Most of the elementary teachers' responses were brief and to one point: science is finding out about life through careful observation. A most holistic response was made by a district administrator:

> *Observation and relating that experience to what you are. That is what the [elementary] teacher has to find out: What the child has in his mind.*

In the elementary school with the "science shack" (to be described later), a primary teacher said:

> *Science is the little science building where more science got taught than in this whole huge building put together. Our schools are being built too large. Science is not a large group activity. It is small, for one person or a small group. The little building had more than the fine science aide; it had the right size for small children to do science.*

The only mention of difference in science achievement or interest for boys versus girls came from science team leaders who felt girls may use science as a "cop out to be cute with male teachers like they do with their daddies." Allow me to jump ahead in the story to observe here that there is little support for the notion that real differences exist for male versus female students in any grade in River Acres insofar as interest or ability in mathematics and science ability or learning are concerned. Important exceptions in high school advanced science courses will be noted. Science and social studies serve many masters in these elementary schools. For some they "humanize" the academic curriculum. For others large science classes permit teachers to slough off students for remediation in reading and arithmetic. For a very few, science is crucial in its own right.

Success

Two outstanding examples of elementary science teaching started working five years ago as science teacher aides in a temporary building ("shack"). Shacks are portable "temporary" units destined to permanently grade this district in the years ahead. One person is now a certified teacher in the district, the other now works principally in a non-science role. As a result, the instructional flow of the shack is currently at low tide. Vestiges of an earlier era are revealed in the shack: hognose snakes, a Japanese racing rat, beaver logs from New Mexico, plants in demijars, sharksteeth, morning doves, pigeons, rattlesnake skins, hutches, fossils, tanned hides and terraria. The aide, now working in reading instruction, spoke to me of interdependence, balance of nature, endangered species, food chains, ecology, pollution and the scientific method. She created "lend a pet" (taking animals home on a trial basis); "the great tree planting project" (1,500!); a "save the eagles" campaign; and told how they even managed to lose an armadillo. She still has a cat with two kittens, an alligator out on loan, cacti and a fossil-plaster mold project underway in her "spare" time.

> *The only difference between boys and girls in science is snakes and worms and that doesn't last long. . . .*
>
> *Resource conservation begins with your own mind. For example, I believe it is important for them to learn first hand that tense children produce tense animals. The cat is disturbed, the guinea pigs, the doves. More squealing, defecating, biting. Kids see that, we talk about it. Environmental balance, interdependence, child rearing, communication of emotions, anxiety teaching. Lots to be learned there. The rabbits who eat their young when they have been held. Our work in the shack makes the [science] book worth reading for the kids.*
>
> *When a child asks how a bird stands on a wire, a more reasonable answer can be found from holding a bird and observing, than from any amount of verbal explanation by a teacher. I try not to give a child an answer. The question means curiosity and that means opportunity for learning--not for getting what's in me into him.*

The second aide who started the shack has become a science teacher at another elementary school. Her present science area has features that include a scorpion, tarantula, parakeet, spider, and an octopus on order. Eastern and Western hognose snakes are in place. The day I interviewed her she was running her two-times-a-week science activity afterschool group. The principal supports her in every way possible. (He was an art major.) Two boys were busily looking for the "lost" iguana in the 21'x9' science anteroom. These "Thursday kids" are a bit squeamish about reptiles, or unclean situations (animal pens). Ms. Rudolph is low key, patient. She feels redundancy is:

> *Very necessary. They'll forget much but re-learn it so much easier later. They might not fully appreciate Newton's Law now but I don't force it. Later they'll recognize having heard of it so it won't be a total shock. They may only recall that objects behave differently in outer space and on earth.*

She is starting to work out her own version of an integrated mathematics, science and writing approach to the curriculum. The principal is supportive of this. (He is the one who thought open space was "nuts" before he saw it.) The curriculum under design will integrate SAPA and STEM into the curriculum. There will be no science class per se. (She would have a science area.) "The way we teach children forces them to see all things as separate institutes; you spell in spelling, use taxonomies in science, measure in arithmetic, think about people in social studies. Where in school do we teach kids to get it all together?"

General Practice

The curriculum guide says "The goal of our [science] program is investigation and this requires activity on the part of the child." There are no Texas regulations on elementary school science content as there are for high school. There has been a state committee at work for several years. How "activity" and "investigation" get implemented range widely from teacher to teacher and school to school. For many of the elementary teachers one grade level team leader said it all:

> *Elementary science is an unnecessarily scary thing for teachers. The technical complexity is not that great. Teachers really do not need to know that much. It is just that we are not prepared to teach it, have bad memories of freshman biology in college, and get no in-service help to speak of.*

Another gave me a cryptic message:

> *Q. Tell me about your science curriculum in the primary grades.*
>
> *A. Well, our rooms have water.*

Science and social studies as a humanizing influence are seen in the comment of one second grade teacher:

> *Science is a child-centered activity in our school. It should be a place where the child finds out how things work for himself. It should be fun. Asking "why" is important and seeing "how" is essential. Letter grades really should not be given. I give a B if the child participates at all. In science we try to expose them all to the same concepts and don't ability group. It [and social studies] is the one academic place where we are all together.*

A fourth-grade teacher described science teaching this way:

> *The schedule is arranged for large classes in science and social studies instruction. That frees up other teachers to work on math and reading. It makes sense because the reading problem is the biggest one we face in [teaching] science. So we have over eighty students in there. Now you really can't hold eighty at a time and we don't try to group them for instruction. Children have a chance to be with their agemates who they normally don't see in class in school. It's random assignment to stations and activities all the way. I think it is a good way to do it.*

The role of the textbook is less clear in science than in mathematics. The curriculum guide was written with the text central to its organization.

> *Our curriculum in science is coordinated by the textbook. It is all there and we follow it. I assume it is coordinated: it better be! (Fifth grade teacher)*

And a fourth grade teacher felt:

> *The texts and concepts in science kits don't fit. Too much teacher-do and children-watch! Open space aids this because we have huge groups in social studies and science. Too large for much besides demonstration.*

And a third grade teacher:

> *The chapters in the science text are far too long. Children would love to have science early in the morning. Several experiments at once just cannot be done with elementary school children. Several things can be done, and most of it would be busy work like skill sheets, individual projects going to the library, reading from the text while one group does an experiment. But only one experiment.*

For those who disvalue elementary school science teaching, one kindergarten teacher speaks:

> *We have two hours and forty-five minutes in our instructional day. Science takes time. [She teaches] a little science before the school's science fair each year. I'll let first grade do science.*
>
> *Generally I don't follow the book. It is okay for the top group but it is dry. The concepts are there but it takes Ginny [the "shack" science aide] to bring it to real life. Reading about yeast does not equal making bread.*

One science teacher observed that some concepts are too difficult for elementary school children.

> *We can get them to use words like "molecule structure, models and chemical substance" and all those good things but they just can't handle it. And our new science program emphasizes that in the second grade. I'd say 75% of them won't get the fifth grade universe science material; "wave and particle theory; and spectroscopic analysis of compounds; and continual motion of bodies in space!" Not a chance.*

The elementary school science teaching I observed was restricted to grade four and five pupils. They moved from one activity table to another following assignments posted at the station. In one room it was six stations with about ninety children and two teachers. One group worked in the resource center. In a second it was three groups with two teachers. Ditto pages from textbooks, commercial and teacher-made packets tell students what to do, how to do it. "Place the litmus paper in the jar filled with vinegar. Note any change in color." After students complete an activity they take a check-up exercise. A general observation of the use of packets in science teaching as well as mathematics and social studies in River Acres K-8 should be made here. Dismay and frustration were expressed by several teachers over the avalanche of paperwork associated with the use of these packets. Several teachers could not tell me who created them; "they were here when I got here."

The poor quality of the mimeographing of the packets was mentioned by parents at more than one elementary school. "My children are doing well, so that is not the nature of my complaint; but they are blurred, often grammatically improper, and just lists of things to do." Another parent saw the purpose of packets as being the "opportunity to do more packets. She finishes one, regurgitates it on a so-called test for the privilege of going on to the next packet. My land!"

At the junior high level parents were critical of several of the packets which they saw as "so much busywork." A particularly irate junior high teacher described her considerable efforts to revise the packets in social studies which resulted in their not being used by the department.

Several elementary teachers told me they were glad they did not have to teach science, because of the open-space arrangement. (Specialists do.) In two schools the science teachers volunteered to do the task. I recall one mistaking me for a college science teacher and asking, "Nothing personal, but why are all science and mathematics professors so blasé?"

The elementary science teachers I saw avoided answering children's questions. One confided after class, "I'm not going to answer the argument about hot-core or cold-core [earth's center]. The kids are going to dig out the facts. That's what science is, finding out the facts."

A particularly troublesome aspect of the science curriculum is what to do with the poor reader? One teacher observed that manipulanda are out of the question for a room full of eighty children (science is always large group instruction in the open-space school):

> *So we put these kiddos in large groups so we can have small groups in mathematics and reading and there is absolutely nothing at hand for the slower than average child in science. We need materials. The teachers are trying. The kids are trying. So it must be the materials.*

A notable curricular difference in the self-contained schools is their practice of having large language arts groups to enable them to have smaller groups in science and social studies.

A fifth-grade teacher of the bottom level children said:

> *Frankly we don't teach much science. Usually science is taught along with social studies and it is in a unit like "Dinosaurs" or "Transportation."*

Elementary Science Interest

Several informants noted a general lessening of interest in science as children moved through the elementary grades.

> *First graders love science. It is exciting and different. By the time they get to junior high some are saying, "Oh no, not science!" When first and second graders get excited about science--magnets are fun you know--they squeal with delight. We somehow manage to take out that fun as we go along. I don't know how we do it.*

Science in general has lost its appeal. The science fairs, so "big" in the sixties, have been reduced to a sometime thing for most schools. Several observed the "parents'" science fairs of the sixties were a mixed blessing. The fairs at once created parental interest in the science education and "terrific competition among the parents for recognition and prizes awarded to [their and] their children's entries."

Teachers gave broad hints at what "works" in teaching science to elementary age children.

> *The things that turn on third graders are things which they have seen or heard about but never really understood.*
>
> *If something does not appear to the child to be related directly to his life then it better be amazing or fascinating. Teacher education is really short of giving us ideas that work.*
>
> *More than anything else, children love experiments. Even watching me do one is better than reading. Doing them is best of course, but there is very little they can really do. Right now we are creating rust. When they read ferrous oxide it means little. But when they see it form, it sticks. This is where the equipment and space become crucial. Faces light up for activities, go blank for reading about science.*

The things that work are not surprising. When children are interested, are active and involved, classes pass nicely.

One of the things that "works" is to avoid assigning reading in science. A similar observation was made by teachers in arithmetic and social studies in all elementary school grades. Reading, mathematics (and spelling) come first. Science and social studies come second in both teacher preparation time and actual teaching time. The principal reason for avoiding assignments in science is two-sided: the texts are too difficult in reading science materials.

I spoke with teachers who work with the lower-level science groups about "hands on" instruction to interest such students. One teacher not without wit replied: "Yes, but first we have to identify our hands." Later this teacher suggested that "hands on" science experiences were needed far more by the upper-level students than by the lower-level students. She was of the opinion that top-flight students could get verbal abstractions quickly without really "understanding it in their bones," which could come through laboratory work. (Presumably the lower-level students would not get the abstractions before, or after, the laboratory experiences.)

Elementary Mathematics

Mathematics teaching and learning can be said to be much like the children's rhyme, "When it is good it is very, very good and when it is bad it is horrid." When mathematics goes poorly in the later grades, especially with the lower levels, the question often raised is, "What are they doing down there?" What they are doing "down there," as I saw it, was what they were supposed to be doing according to the district curriculum guide, the teachers' objectives and what the teachers said they were doing. There are thirty instructional levels spread over the five elementary grades. Each level has skills and subskills spelled out in the curriculum guide that generally parallel the textbooks found in the classrooms. For example, in grade four, three of the sub-skills emphasized are:

Number Theory:	Finds common multiples, uses exponents
Fractions:	Adds fractions; subtracts fractions
Operations:	100 addition, subtraction and multiplication facts and 90 division facts by memory.

The textbooks in use often present more than one way to approach the solution of a problem. More particularly this is offered as help in teaching a skill. Teachers see this as confusing to the child. Children say it is confusing to them. "I don't get it. Which way is right? Do we have to do it both ways?" So the teachers select one way and teach it. Then the kids end up weak in mathematics skills according to the junior and senior high teachers.

To achieve individualization of work for low and high achievers in mathematics, teachers use lots of duplicating masters. On any given day one can observe most children in grades four and five working on "individual contracts" which are packets of prepared master dittoed sheets stressing specific arithmetic skills. Teachers recognize that children may do the contracts to finish them rather than to understand what is in it. "But what is the alternative?" they ask. "Mass group instruction," they answer.

My observations and conversations lead me to say they were teaching what they are supposed to. Not merely at the fourth grade, or at the elementary school; rather, the curriculum was what it is "advertised to be" from K-12. One teacher in her early twenties said a lot for the spirit and practice of mathematics teaching in River Acres when she said:

> *We are terribly old fashioned and I am proud of it. It is old fashioned and super to expect every first grader to have "rapid memory" of basic facts to ten. We also expect fast first graders to have rapid memory to twenty. You get what you expect in teaching and in life. When it gets down to it every teaching technique that works is an old fashioned one that involves understanding facts and remembering them quickly. The really able children and people are the ones who have the concepts under the rapid memory.*

Is speed in elementary mathematics important? Most feel it is and that flashcards and board work can help in this matter. A few question the importance of an emphasis on speed: "It is not how fast 7+8=15 can be given that the mathematics teacher should watch; it is how much 7+8=15 means."

There is no evidence or feeling that boys are more apt or interested in mathematics than are the girls in River Acres. There is some concern that grouping (levels) results in Black or Mexican-American children rarely being in the top groups. In general the achievement scores in mathematics have risen steadily for all elementary grades since 1970 and are at or above national grade level standards. Some attribute this to better teachers --most to better learners (due to in-migration).

A district administrator told me that mathematics teaching is in the planners' minds when their elementary schools are built: "We design elementary schools to deal with sixty kids in art, science, social studies and music so that reading and mathematics can have ten." But primary teachers feel the pressure coming from "above":

> *Our team feels in general that the buck gets passed back to us and the buck is one denomination: reading. We have to get the reading job done. Science, math and social studies can wait. But mathematics and reading go together pretty much. Twenty of twenty-five children are in the same block in reading and mathematics.*

And a few later elementary teachers have their doubts about what's going on "below."

> *I have just spent four weeks on one digit addition and I really represent this. [Block 4 lower level; there are four blocks and each has an upper and lower level.] What have they been doing for three years is what I want to know. [She had not taught primary.] Only block 1 is on grade level in mathematics.*

One teacher felt the many levels may confuse parents and perhaps go against what the parents expected:

> *The levels 1-18 that we developed in the past don't match what we are using now. The parents have to be confused by this. We'll get it worked out. For example, levels 1-6 mean completing the first grade. The parents who understand that don't like it. They don't remember school being like that. What they do want is more and more, earlier and earlier for their child.*

Not all are pleased with the recent district efforts to monitor instruction and achievement by having elementary teachers complete checklists on student mathematics skill learning. One open-space teacher exclaimed:

> *Filling out record sheets on each child is silly; I have to record that on March 30 Billy knows his facts from one to ten. So what! I'm going to check to see if he knows them anyway. If he doesn't, then what? Do I go to Mrs. Athens and ask [what happened last year]? If she says she will do her best to teach them that's good enough for me.*

A third grade teacher in self-contained classroom pointed and cried:

> *That sheet! [in math] No teacher needs a sheet to know whether a child can add 4+4. And we don't make any use of the date the child was checked as knowing 4+4.*

What's the Big Idea?

What is math? I asked scores of teachers this question and the answers generally were "logic" and "computation." In the course of their telling me about math, the topics of modern mathematics and back to the basics recurred. They said:

> *I never saw it [modern math] work. [At third grade.] It puts kids into junior high school math with expanded sentences and all without having the basic addition and subtraction facts down. We do talk with the first and second grade teachers about our children's weaknesses in basics. But we are all using the same text and following the same curriculum. Next year it will be better with the new books.*
>
> *Six years ago we made a mistake and went too far in teaching abstractions. We had to; we had no choice. All the texts were modern in Texas. Worse, we had a 1-3 grade series and a different one for grades 4-5.*
>
> *I was told that the reason the new math was brought into being was to satisfy a child's "natural curiosity." And I thought that was a ridiculous statement; because who's curious as to why 5+2=7.*
>
> *I can tell in a second if a school has gone back to basics in the second grade: look for the flashcards.*
>
> *Modern mathematics? I dislike it. Too many ways befuddle young child. I skip what I think is useless and use what I think is pertinent. I really think Addison Wesley shows three ways when one will do. The brass tacks are learning addition and subtraction. That's it.*
>
> *I dislike our book, not enough drill, it's modern math. We adopted a new book. I don't know its title but it has more drill, more basics and I'll like it.*

Some work has begun on metrics but the progress is not clear.

> *It [the new text] has metrics. But confusing. Could be an in-service opportunity for teachers on this. (A second grade teacher)*

Teachers feel some expectations for elementary school mathematics may be too high:

> *Understand place value to millions for a third grader?! [Continues reading from the district Mathematics Guide] . . . "develop skill in subtraction with and without regrouping through hundreds place. Understand inverse relation between addition and subtraction." Half the parent-teacher council couldn't do what we are expected to have our little third graders doing by April.*

A secretary in the board office showed considerable interest in the questions I was asking teachers and students. I asked her what she thought mathematics was. Her reply stuck with me through and long after the study's completion:

> *I don't know how to say what mathematics is but I can tell you I learned to hate it in Miss Adams' second grade.*

Mathematics Texts and Expectations

Reading is king of the elementary curriculum. Teachers agree that mathematics is the next most important thing to learn in elementary school. The sixteen reading levels in the first five grades are based on two or three basal reading series and considerable machines, labs, games, kits and a variety of other supplementary materials. The importance of reading instruction is manifest in attitude as well:

> *If I wait until one o'clock to teach my first graders reading, I have waited too long. In some cases it [learning] is all over by ten o'clock.*

But poor readers often have trouble with mathematics:

> *We just do not have curriculum for the child who has difficulty in arithmetic. What we do is slow down, take smaller bites, do it more often and pray. Often the child will have reading difficulty, too. Then that child is really in trouble.*

Teachers did not call for research or for evaluation of instructional materials or the curriculum. They want help, now. They have three widespread concerns. My notes contain thirty-seven separate pleas (not all elementary) for materials, procedures, aides, or supervision for slow children in mathematics. The harshest self-criticism made was in the mathematics instruction of students in the lower levels. An elementary school counselor observed:

> *Slow children are confused by the missing number equations. I've seen five years of them bewildered by 3+?=5. They need to manipulate concretely for a very, very long time before memorizing the 3+2 fact.*

Nine teachers in ten follow the mathematics textbook, "sorta." A first-grade teacher finds her book:

> *. . . skipping around from concept to concept (four teachers concur). The visual clues in the text do not work. They are cute "stylized New York" but don't mean a thing to Texas kids.*

Another said, "They [text diagrams] are pretty, but the kids don't catch on."

> *They give two pages in subtraction before going to mixed addition and subtraction problems. For the low group we need at least two weeks, not two pages, on subtraction before going on to mixed problems.*

Listen to elementary teachers speak to book publishers!

> *In the context presented, the bar graphs cannot be used . . .*
>
> *The book begins with the assumption that shapes are known to kids. Poor assumption. Many first graders never get their shapes and names down . . .*
>
> *The book is inconsistent in format. Moves from left to right then from top to bottom then reverses within a very few pages.*
>
> *They take up grouping and place value at the very beginning of the book and that's too abstract a way to begin for six year olds.*

A second-grade teacher expressed other textual difficulties:

> *. . . Sequencing is poor: from addition to multiplication to geometry back to multiplication to fractions to multiplications to I don't know what.*

The crunch comes in third grade:

> *Third graders roll along until they hit inverse relations. Boy, when you hit subtraction the world comes to an end!* $3+4=7$ *okay,* $4+3=7$ *okay, but* $7-3=3$*? Lord!*

Another third-grade teacher finds:

> *This book has too much esoteric garbage in it. It is simply too hard. The geometry is silly [to [illegible] and teach] even for our best third graders. So we all skip it.*

Still another third-grade teacher comments on a (different) math text:

> *The textbook says to show method A for regrouping in addition and then to switch to method B. Every teacher in the school knows this confuses kids. So we don't show kids method A.*

Fourth-and fifth-grade teachers describe yet another publisher's series:

> *The text doesn't flow from one page to the next. The principles of multiplication, addition, division and subtraction are unrelated. For example:*
>
> $5x3=(2x3)+(3x3)$
> $15=\ 6\ +\ 9$
>
> *Why should the kids learn this? All the teachers here would agree with me. It's really a stinker. The text assumes that if a kid can reason through one problem the kid can do them all. This is true only for the above average kid.*

Almost to the teacher there is a sigh of relief that the "modern math god" is dead.

> *We are fortunate not to have gone way out for the new math. We have stuck to the basics throughout it all and the results that are coming in show we were right.*

Boredom

Student attitude toward mathematics is a most frequently heard topic (after learning the basic operations) in the dialogue on elementary school math instruction. To counteract student and personal boredom, teachers create a variety of games, ditto masters, puzzles, approaches.

> *Doesn't have to be dull. Everybody likes to talk about themselves; to work on a problem that is their own problem. So I always use my kids' names in the problems and make the problems something that relates to their lives in school or out. (Grade 2)*

> *There is no way on God's green earth to teach mathematics without a lot of drill. It could, can, should be fun. (Grade 3)*

> *We adopted the [new] series a year and a half ago. Where is it? It has games, hints, ideas, activities that we need to spice it up. (Grade 1)*

> *Fifth graders are harder to motivate than are first graders. By the time they are in the fifth grade they have had the whole bit. They get the same things they didn't understand the first times back again and for the first time honest to goodness boredom is felt about mathematics--even about science. (She was a team leader at Meadows fifth grade.) Then there is the universal of fifth grade spring for some of the girls. Whooop! Tears, friends, menstrual cycles, how do I look?*

Another teacher (in her ninth year of teaching) spoke for several when she sharply distinguished high-achieving math students from the boredom of others:

> *You might as well forget about teaching conceptual mathematics to 75% of the children in elementary school. The upper level children like it. The rest are not only bored--they hate it!*

Another fifth-grade math teacher linked the elementary school experience to what she thought was coming in junior high:

> *When [lower level] kids in the fifth grade get to junior high school they had better be ready for boredom. It hasn't changed much from when I was there. At the end of the fifth we identify skills and deficiencies in skills. Generally what we hear from the two junior high schools [one-fourth go to SL and three-fourths to MC] is, "We don't have time for all that, just give us the level." When in the sixth grade that means the lowest level gets the lowest level book and no deficiency skill program is followed to help them. It's smack into the book.*

What is coming in the junior high for eight students in ten is a lot more of the same. For the very able it will be pre-algebra; but that is getting ahead of my story.

Elementary Social Studies

I paid far less attention to elementary social studies than I did to science and mathematics. I believe the teachers do, too. My question as to what the "big idea" was in social studies brought little beyond "history" and "geography." A fourth-grade teacher offered a comment on the lower priority assigned social studies: "In the self-contained classroom teachers set their personal priorities and science and social studies turn out to be step-children."

While some teachers find social studies teaching most rewarding with the most able children, I found none who enjoyed social studies teaching with the least able.

> *Block one kids are really interested in concepts like continental drift. That concept is too far above the average block two's head. So the difference is really a big one. It is not just a matter of a little difference.*
>
> *The book is filled with irrelevancies. I have to dig to relate it to my children's lives. The science book, on the other hand, is easily related to their lives. They need a lot of help with observation. We are creating a society of non-observant children.*

In the open-space setting social studies seems to moderate the effects of grouping in other subjects.

> *I feel science and social studies gives us the one place in academic schooling when the lowest kid can really participate in class. There are so many things that can be done that are fun for children of all ages, abilities. It is vital that we keep science and social studies informal in a school that homogeneously groups in reading and mathematics.*

A social studies teacher pointed to the state accreditation principles and standards and commented that, "If the geography doesn't get better soon around here somebody might make an issue out of this." She pointed to standard 4 under principle XI which treats the matter of total school or departmental quality: "No segment of the school is overcrowded or underequipped in order to maintain the program of another segment." She warned:

> *We have large social studies classes to let them have small classes in reading and math. We aren't getting them taught any geography this way. It's awful what they say in high school about it and they are right.*

But she was a rare bird in the elementary social studies aviary. The curriculum could disappear tomorrow and no junior high school effects would be noted.

An assistant principal has his personal set of indicators about the status of the elementary social studies and science curricula.

> *A "dead give away" to our unsure attitude toward social studies and often science--this is an attitude, not necessarily whether we are competent or not--is the number of films or film strips we use and show in science and social studies. Too many teachers show films and call it science. Take the heart of the elementary curriculum: reading, spelling, writing and arithmetic. How many films do we show there. Very few indeed. We know what we are doing there. It is not that we don't use them . . . but judiciously. In science, we are in desperate need of help so we turn to films. The printed materials will only get us in deeper trouble with the weak-skilled child in reading. So we turn to the non-print. If we had instructional television in the building you would have proof positive, I believe. The Mr. Rodgers, and National Geographic specials would be on all the time. But we can do as well or better than Electric Company in teaching reading. A lot of teachers in the elementary school are just plain afraid of science. And a lot of teachers in the junior high school that aren't should be.*

Social studies is felt to be a filler in the curriculum by one primary teacher:

> *If I were to follow the curriculum guide for the primary I would teach Minneapolis on Tuesday and steam on Thursday. The kids just cannot jump from Minneapolis to steam at seven years of age and make sense out of it. (Chapter two in second grade social studies curriculum uses Minneapolis to illustrate the growth of communities.)*

A second grade teacher is trying to emphasize personal knowledge in her social studies teaching, to get it "out of the doldrums."

> *She has tried "My Name" first unit. Fun. When someone used your name and you did not know he knew it, how did you feel?*
>
> *Draw a picture of yourself today. When you grow up. Guess who this picture is (teacher shows class self portraits). Teacher said she never did any real social studies before this.*

It's easier to plan a social studies unit than to plan a science unit. Children are really interested in science, but what they can do and learn something from is hard to plan.

For the most part elementary social studies is taught without regard for what is coming in the year(s) ahead or what has gone on before. It is not seen to be "cumulative" as mathematics is seen to be. The senior high social studies teachers will comment on this. In general, elementary school social studies is a low-problem-no-trouble aspect of the curriculum.

Curriculum Problems

There is apparently no one in the district with the job or ample time to explore curricular problems at the depth and for the duration required to understand what may or may not be happening in the science, math or social science curriculum. From time to time in my study I found most perplexing information. For example one day I pursued with the counselor an observation made earlier by a math teacher. The observation was that over several years a sizable group of children had first, a markedly different achievement in math and reading; and second, that the more able students were better in math than in reading and less able students were better in reading than in math.

We took an hour to pull reading scores of two arbitrary levels of students at one arbitrary grade just to see what the achievement test scores were. If the student had scores greater than one year apart we called it a difference. If it was a year or less we called it no difference. Here is what we found:

	Math-Hi Read-Lo	Read-Hi Math-Lo	Same
Level 2	15	2	7
Level 6	2	10	8

Now what can that mean? And is it true for other grades. For other levels. Is it just the test being used to measure math? Does it have something to do with teaching math? Is it true only at that school? Probably no one knows. Even if one wished to explore such matters, the time required and personnel needed to explore curriculum issues are not in River Acres.

The Great Mystery

There is a specter residing in the minds of River Acres' teachers which I called the Great Mystery. Although I love a mystery, I never initiated the topic. In its mildest form it merely can be called "forgetting." I think it is a crucial issue in teaching. Let's begin with elementary science.

Today we did Isaac Newton and gravity. It was fun and the children loved it. By the end of the day I felt that the lowest group--most of them had a grasp of gravity. They might forget it by tomorrow. But we'll review it for a couple days and at least they know there is something holding you to the end of the earth.

Now a math teacher speaks:

> *Except for the "block 1s" (35 of 140 third graders) all third graders know one thing perfect in math one day and the next it is gone . . . I mean GONE. (She has all the block 2s--average kids). It is a week to week, year to year experience. I have had children for three years in a row. Knows his facts up to 19 in addition beautifully in May, comes back in September and he's forgotten them. I mean zero retention. Now what I want you to know is that ALL the kids except block 1, and some of them too, have this mysterious "forgetting disease." Last week I had the "2s" borrowing and carrying and I was so happy and we were all dancing. After Thanksgiving they came back and acted like they had never heard the word "borrow." Borrow!? Teachers live with this. They see it every day and get used to it, so we don't talk about it. But it's there teaching math; day to day.*

A fourth-grade teacher discussed the mystery in the context of her concern for the amount and complexity of mathematical information and skill being "pushed downward in the curriculum":

> *I taught the basic addition facts in the first grade to these very same children. I have complete confidence in the [mathematics] teaching of my friends here in the second and third grades. I know they did it. And we use all available manipulative materials, counters, popsicle sticks, filmstrips, flashcards, you know. Now I have the same little people I had three years ago. The mathematical understanding is still there, but the proficiency is not. Summer [vacation] forgetting hits them every year. I can tell you they had it to 18 [the basic addition, subtraction facts, no carrying, borrowing]. They lose it, find it, lose it. Maybe none of the 18 is really a part of your system, a part of you. It's too-much-too-early maybe. Number readings is greatly overemphasized in kindergarten. We take pride in teaching more, faster, earlier. Teachers [first grade] will say, "I had my top group in second grade math in February." We really don't know what difference that makes.*

Another mystery story had several tellers. This one is analagous to the good and bad years for wine with the school reasons not being so obvious. An administrator tells us the first story:

> *The fifth grade class at X has a history of a total class of children. Last year we had a responsible group but far less responsive than this year's. I am thinking about both groups during November and December. A few years ago we had the most immature and sweetest group I can ever recall. What makes that? The kindergarten teachers say we have a bunch of holy terrors coming. I didn't believe it until I saw it.*

The River Acres teachers and staff would welcome assistance in analyzing and combating these problems in the teaching and learning of mathematics. It is a growing problem in the minds of some. In fact, the overall difficulties in teaching mathematics to the 50% of the students below average may be increasing.

> *The more able students are getting more able and the less able, less able. It is clear that in mathematics that those who are "getting it" are getting more of it, and faster.*

Help Wanted by Elementary Teachers

Several suggestions for welcomed help were offered by elementary teachers. The most prevalent, noted earlier, was a plea for help with teaching mathematics to children who have difficulty in learning the basic facts. Others call for help in teaching the metric system.

Dozens of elementary teachers, particularly in the fourth and fifth grades, want to meet with their high school counterparts in social studies, science and mathematics to show them what they are doing and to find out what their children are heading for. For example, they want to find out why children who are "sailing past fifth grade science and math" should not be given sixth grade materials. They are puzzled by reports that the boys are more outgoing in junior high and the girls shy. Is it because there are more male teachers? Because the organization suits one sex better?

They feel that cross-grade meetings would help junior high school teachers see what they are up against. An experienced third-grade teacher now teaching first grade for the first time was:

> *. . . amazed at how small these children are. You need patience beyond belief. When I taught third grade I really could not understand why more than one child in ten was not reading at grade level when they came to me. Now I expect 50% to reach grade level if I am lucky. I think 50% is a reasonable expectation in mathematics, however. Kids don't come to school knowing how to work in a group for instruction. It's so obvious, but I thought they did somehow. They have to learn to stay in line, stay in their seat, take turns, not talk when others are. There is very little a first-grader can do by himself [that helps in group instruction].*

Another first grade teacher said it all when she said she doubted that junior high teachers know that:

> *When I say "Put your heads down on your desk," it literally means absolutely nothing to almost all my class when we begin the year. That's how far they have to come.*

The staff of the elementary school that exchanges grades one day a year were most positive about that experience. Indeed, it has changed careers, initiated discussion and made everyone closer in their feelings toward one another.

A principal called for in-service workshops on the differences between elementary and junior high schools, so "we can really talk with one another for a change."

> *We treat them like children in the fifth and then after three summer months they become "students." Most elementary school teachers think they are there to help children with their learning mathematics and most junior high school teachers think they are there to impart mathematics to students who want it. Elementary school level three kids get taught where they are, whereas junior high school level three kids get taught the same as level two, only slower. What this ends up as is moving from slow achievement in the fifth grade to total failure in the sixth. The junior high school will say it is because they are having a tough time to adjust to junior high school. I say they aren't taught anymore. It's either them or us--one of us has to change.*

Not one member of the entire elementary Lincoln faculty knew what the junior high science curriculum or instruction contained or emphasized. Same thing for social studies. Same for math except that fifth-grade teachers knew about sixth grade pre-algebra classes. This meant they identified their "best" math students for that class; that's all. They all said they would like to visit to learn more about junior high school.

A former high school science teacher who now serves as a district administrator believes part of the cross-grade communication difficulties would be eliminated by viewing the junior high school as its name implies; i.e., a junior version of high school.

> *These grades would be better served by an interdisciplinary approach. It is a* *junior* *high school. We do not have the middle school concept in this district. State regulations say we can do junior high school any way we want. We could fuse English and reading/writing/spelling, which now are separate with unnecessary duplication. Social studies could be fused with English, too. This would be an easing of the K-5 to [grades] 6-8 transition for students who are neither fish nor fowl the way it is now.*

A comment on the real world of elementary classroom teaching seems in order here. When I interviewed this teacher in the course of a part of that interview I noted the decisions she made that I could observe. Thirteen decisions in ten minutes; she reacted to the following:

> *"What color t-shirt should I wear?" "I don't understand this part." "What page are we on?" "Can I use the flashcards?" "I can't do 16 take away 8." "My eye hurts!" "Billy is cheating." "What does this word say?" "What does this mean?" "Billy is still cheating!" "Do we need our boxes?" "Some people didn't push in their chairs." "Is this good work?"*

For those who regard the task of the elementary school teacher as less difficult than that of the secondary teacher, I offer the following from a secondary science teacher:

> *When I was single I could teach elementary school. I could devote my total self to it. And I did. I planned nights for individual children. Honestly, now that I have a family I can't. And it's impossible to do it for 175 anyway. So to make a long story short, I'm not in elementary anymore. Most elementary teachers can't do that because they don't have enough hours in science for certification.*

The elementary schools of River Acres are pleased with what they are achieving with their children. Texas poet Ruth Roberts did not intend her poem to speak directly to that sense of pride, but I found it apt.

INSIDE OUT

I watched her safely to the door
Then, job over, I relaxed and smiled.
But what, my (classic) still, small voice
    of (historic) conscience/guilt asked,
    if there are devils within?
Those? My answer, in a newfound
    tone of reason,
    strong and clear:
She'll have to deal with those herself.

Ruth Roberts

THE JUNIOR HIGH SCHOOLS: GRADES SIX, SEVEN, EIGHT

The report is now divided to present views of Westland and Eastland Junior High Schools. Both are open space and both were opened in the past two years.

If the reader has read the descriptions of the use of open space for team teaching in the elementary schools of River Acres, a word is in order about open space in these junior high schools. Labels are convenient and tricky. The twenty-mule Borax team had eighteen mules and two lead horses. Open space in the junior high and elementary schools are the same in name only.

Both junior high schools have nearly identical instructional curricula, the same procedure for assigning students to three instructional levels, with minor variations, similar materials and building architecture in the science, mathematics and social studies. Team teaching is infrequent in both and neither individualizes instruction in the three curricula. But, I felt the newness of Eastland Junior High (opened three months), its size (500 additional students in approximately the same basic plant), and unique themes which appeared in one and not the other suggested the advisability of a separate presentation.

Westland (WJHS) and Eastland (EJHS) offer the same curricula in science, mathematics and social studies insofar as courses are concerned. Neither does anything special for its Mexican-American or Black students insofar as staff recruitment is concerned. They do provide a federally funded remedial reading program. As one faculty put it:

> *The problems the Latins have are in English, not Spanish. Arithmetic is the same in both languages and they must learn English or they'll never cut it in Central High.*

Because of its minority student proportions, EJHS is recognized by the National Student Defense Fund as a loan-approved school for college graduates to teach in. This means a fifteen percent reduction in the loans they took out while in college. Westland Junior High School is not so classified.

What is a junior high school? Some say it is a holding area until puberty is in full swing. Others regard it as a prep school for Central High School. I heard senior high teachers say that WJHS and EJHS teachers do not challenge students enough in math and science--especially math. It is not a matter of misinformation or a lack of communication as some would assert. The senior high school science faculty use a different stick to measure educational progress. They judge a junior high program that has been called "excellent" as being "thin in content" or "low in expectations." They have different standards. They will speak for themselves presently.

Both Eastland and Westland faculties have teachers who, like their elementary colleagues, are concerned about the increasing difficulty of the total curriculum in River Acres.

> *Earlier and earlier we expect more and more. Where will it end? We pay for it earlier and earlier, too. Scandinavians do not start their children until age eight. Their literacy rate is better than ours. In two years their children are caught up with their European counterparts.*

In both schools the three curricular areas treated in this study are presented separately and emphasized equally. With only the rarest exception is an attempt made to fuse, integrate or in any way relate the mathematics content with science or the social studies.

For example, a department head in one of these schools will not tolerate any discussion of coursework other than that taught in his subject. It is not so much preventing the crossing of subject lines that characterizes Eastland and Westland as it is expecting that the courses ought to be kept separate as they are in high school.

Westland Junior High School

Clean, carpeted, orderly, open space, good lighting, friendly-but-tough principal sets the tone.

So ran my notes from the first, quick visit to the school. They represent fragmented impressions that still seemed about right three months later. Before long I started to see the mathematics teachers working with their calculators in their areas, grading, proctoring examinations; the science teachers going to the electronic test scoring machine. I started to hear the noise of instruction coming through the noise of my initial confusion. The noise level (quite reasonable for 175 kids and 7 adults in a mathematics area) is, nonetheless, terrific. Teachers are literally shouting their lectures, directions, questions at kids. (Not on disciplinary--but on instructional matters.)

Kids in all levels of science and social studies are "dressed up." For example, in a class of 3s (bottom) in science the last period of the day, I saw ten girls with hose and six with pant suits. The boys, less obviously "dressed," nonetheless had on expensive boots, Adidas track shoes, Southwest jewelry and other accoutements that complimented the girls' attire. Teachers say the richer kids from two of the more affluent feeder elementary schools get along better with students fed to the junior high schools from poorer neighborhoods than they do with other affluent kids. I observed no social-class tensions in these schools during my work in them.

Westland had about 1,000 students at the time of my visit and had been open for a little over a year. Its principal, an enormously successful football coach in years gone by, was enthusiastic about the study. He runs a tight ship with a heavy emphasis on humor, clear expectations for student conduct, and complete delegation of instructional authority to the three department heads in science, mathematics and social studies. Simply put, he views the world as imperfect but reminds his faculty and students that we are all lifetime members. "So let's quit complaining and go do all those good things."

Westland Junior High School Science

The junior high science curriculum, sixth-grade general science, seventh-grade life and eighth-grade earth, does not build on the elementary science curriculum in either junior high school. Teachers do not assume that students have certain scientific understandings, or have laboratory skills, or come with a common curricular experience from the River Acres elementary schools. Nor do they fault the elementary schools. Rather, it is not expected to be otherwise. In fact, the junior high science teachers know little about the elementary science curriculum.

State accreditation standards account for several of the ways we do things here. While elementary school is not detailed by the state, junior high school science must offer three quarters of science which must include earth and life. (Not specified which one is two quarters.)

> *RAISD exceeds those standards by offering one year of physical science in the sixth, one year of life science in the seventh, and one year of earth science in the eighth. (Evidence that they take science instruction seriously.)*

The feeling that science is as important as any other subject is widespread in both junior highs. This was not so in the elementary school where reading and mathematics were "it." The difficulty many students have with reading and mathematics made science "less basic" in the eyes of one science teacher--but she was the one exception.

> *I guess this isn't science, but the minimum [basic] should include accepting responsibility for themselves in and out of school. That could serve as the bridge between school content and the real world out there. We all want science to be a good preparation for all the kids' lives. Science will be more likely used in life if personal responsibility is accepted.*

Open Space

Open space is regarded as a mixed blessing at best by the junior high school science faculty at Westland. They regard it as a slight advantage for one small class (fifteen) of below average students, but as "impossible" for another ("the zoo"). Most teachers feel open space moderately distracts their average students and is of no importance insofar as teaching science to the top group. One veteran teacher saw the open-space noise problem as, "A teacher, not a student, problem. The kids don't care one way or the other." I observed one teacher on two separate days managing to achieve a sense of intimacy with her group by bringing them close together. She was exceptional; I never saw students seated on the carpeted floor.

A veteran teacher detailed some of the shortcomings of open space as he had experienced them.

> *We have the equipment and the supplies. We are blessed. Beautiful structures, these buildings. Now I'm going to tell you something that sounds foolish: in all this open space we have no space. We have no quiet space; no small space, no diversified instructional space.*

What's The Big Idea?

There is no issue as to what constitutes science at WJHS. Faculty point to the topical headings of the Guide or the chapter titles of the text.

There is little faculty enthusiasm for teaching "scientific inquiry" or for "teaching inquiry by the scientific method." Further, there is the prevailing view that, "Those who promote inquiry over facts and concepts are hurting most students. Only the advanced students can benefit from that."

The Curriculum

A decade ago in River Acres the junior high science curriculum was in the hands of one man. He used early versions of NSF earth science laboratory materials. He had to re-write his own version because mathematics was way beyond most of his students; too hard for the students and the teachers. This was especially true of meteorology.

> *Sizable portions of teachers in NSF institutes in meteorology were hopelessly lost in the mathematics of meteorology. Imagine what the teachers felt who tried to use the materials who never attended NSF upgrading institutes!? It's embarrassing for a teacher to be in that position.*

But that was a decade ago. He has since retired and so has much of the curriculum he invented. Current curriculum development is of less certain origin.

> *I don't know who it is but someone in this district wants everyone to be at the same place at the same time.*

The science curriculum, including a new Guide, is not seen as troublesome or in need of change by most of the staff. The exception (of course) existed.

> *A hodge-podge. The sequence is without justification. It does not proceed on a knowledge development basis and has questionable redundance: biomes, biomes, biomes. Life science is too varied and complex to be wasting kids' time.*

The place, time and difficulty of teaching physical science in the secondary school is an issue in River Acres. The aforementioned experiment involved these questions. This year it is in the sixth and ninth grades. The difficulty lies in part with staff training. It takes considerable preparation time and "there are no good physical science texts for grades six, seven, and eight," according to many of the teachers. Teachers feel they do not have the time and in some cases the talent to do all the things the curriculum (text) seems to call for. The library and resource center are used occasionally by the staff--almost never by the students in science.

Students are often unenthusiastic about the earth science curriculum, say teachers. (Students confirmed that in an interview.)

> *Some children feel that this is not science. They associate science with plants and animals in the elementary school. It is no fun; it is boring, they will say. Mostly book work and facts and memorizing things. They are welcome to the dessert, but they've got to eat their oatmeal first.*

Two items that did not prove to be of importance were team teaching and standardized tests. In science class on occasion a teacher replaces another as a lecturer to relieve student (and perhaps faculty) boredom. Cooperative team teaching is not used. The district's tests are not used by any of the faculty to plan or conduct instruction in science. The purpose they serve is to enable a counselor to place students in science instructional levels.

A year ago an experiment was tried--earth, life and physical sciences were taught by each faculty member at each of the three grades at all the levels (there were four then). It was discarded this year, being viewed as a chaotic failure by nearly all the faculty. Its intent was to add coherence to the faculty's understanding and implementation of the curriculum. Its effect was to expose their shortcomings and limit their strengths. (So much for innovation.) The faculty voted overwhelmingly to discontinue it. Two teachers told me that the experience of their children influenced that decision and many of the others they make in education. During the course of this study I must have heard a dozen teachers cite their own children's experience as the justification for the actions they took or the views they held as educators.

Instructional Levels

Although teachers claim the average student is at grade level (as do their counterparts at Eastland) they feel deeply about their instructional ineffectiveness for poor and many average students. It has nothing to do with science per se.

> *I have no earthly idea what they have had when I get them in the Fall [sixth grade]. The key to it all is placement. When we place 'em in the right level things go pretty well. [The counselors do most of the placing of the students initially.] Level one really hums, level three is good for individualization. Level two is a wide mixture. They are so diverse. They could be 1s or they could be another zoo.*

The "zoo" reference is to a particular group of level three students that exasperates each teacher that works with them. The manner in which students' achievement is measured by teacher-made tests varies systematically from level to level. Level one can mean short written answers, can also be longer, more complex; for level two it is multiple choice or fill in the blank; and for level three it is always multiple choice with a narrow range of facts being tested, or select the answer with the aid of their "note fact-sheet" provided by the teacher for the text. Besides "the zoo," the level three students are described variously as "sullen and partially cowed"; as having "language problems"; as students who "can't read, write"; or who "don't give a hoot." Consensus has it that open space and level three don't mix.

One teacher saw some level three students as being " . . . somewhat ripped off by the system. River Acres fails a few who are very slow, but who are okay really." She felt these students could and did understand physical science concepts but read and wrote so slowly that they could not keep up and always did poorly on tests.

The core content of science instruction is similar across the three levels. The "ones" get it all, and more. They can volunteer to be assistants to wash equipment, set up demonstrations and are allowed to use non-chemical, non-flammable equipment. "Top group competition is fierce," said one teacher in my exit interview.

> *We need a low reading curriculum for the low 3s in science. I take level two material and condense it for the 3s. They just don't care or they are LD kids. Some just can't work in a large classroom. So I cut out the details and just give them basic understanding, orally. Nothing in depth is possible. You can't plan for a level three class in science. [Competition does not work.] Just begin by talking and then move on.*

When science teachers work with the top-level students they are prepared and so are the students. What neither are prepared for are the questions spontaneously generated during such lessons, one of which follows in excerpted form.

Light refraction. Mr. Parker is ready shortly after the period begins. He has a projection of light refracted through a prism. The colors on the projection screen have been labeled and he begins:

> *"Ok now, when we talk about refraction what do we mean? I mean what is the difference between refraction and reflection, Nan?"*
>
> *"Reflection is light bounced off and refraction is light redirected through something. Like that thing [someone says 'prism'] there."*

"Ok good, now when we see light refracted as we can now we know that it is what . . . is always there and the colors we see are always there--even when we cannot see them as we can with the aid of the prism. Any questions about that before we go on? This is very important that we have that in mind." (No questions; class is attentive.)

"When light is refracted as Nan said, it gets broken up revealing its colors. After a rain storm you sometimes can look up and see what?"

"A rainbow."

"Right, a rainbow. And what is a rainbow? Right, refracted light."

"Is it reflected too?" (asks a boy).

"Yes."

"Why are there only three colors in a rainbow?" (asks a girl).

"Ok, let's look at the chart. (A long explanation ensues about the spectrum, what lengths of rays are perceptible, how these are the only ones that could appear to be there.) I know that is hard to understand, but I hope it helped you. Did it?"

(Girl smiles and nods.)

"Mr. Parker, why does it hang together?"

"Why does what hang together?"

"A rainbow. I mean why don't we see a whole bunch of three-color spots in the sky instead of a band?"

"That's hard to explain. You just don't know enough yet to explain that. But keep thinking. That is a good question."

(Same boy continues) "The one that really gets me is why does it [rainbow] . . . " (He then moves his hand in an arc simulating the shape of a rainbow on the horizon.)

"It forms an arc because that's the only shape it could take optically. I think we had better get back to the prismatic refraction."

Mr. Parker told me he "just hates it" when he cannot answer the students' questions. He feels that no matter how much he prepares, their questions will reveal his inadequacy. "So I just keep up with yesterday and let tomorrow take care of itself. I wasn't trained in physical science but I believe it is better to let students ask questions than to try to bull it through."

The thing I shall remember longest about the science curriculum at WJHS is teachers rushing to and from their instructional area to make phone calls to parents. Every morning, afternoon, lunch period, preparation period and between periods. Calls, calls, calls. If activity reflects purpose and the most activity represents the highest purpose, I know what is foremost in the minds of the science teachers: informing parents about their children's progress--or more likely, the lack of it.

Westland Junior High School Mathematics

Westland mathematics instruction is organized around two textbooks and three instructional levels. Two of the teachers made minor criticism of aspects of a text. There is no team teaching and the open space is divided into separate classroom areas.

The counselor pointed with pride to a group of about fifty students whose scores were at or exceeded the 90th centile on a national achievement test. The distribution in a grade is roughly 65 in the top "accelerated" group, 240 in the "average" group and 65 in the lower "basic skills" group.

The big story here and elsewhere in River Acres is the low achiever in mathematics. A seventh-grade teacher has little hope for a "breakthrough" in helping teachers work with the slow math students.

> *The largest problem a teacher has with level 3s is thinking they can learn the same thing in math as level 1s. Their conceptual abilities are limited. They can't get deep understanding no matter how many times they do something, how cleverly we present the material. They are going to have to be able to multiply and divide when they get out there. What I am personally concerned with is that they have the skills they need for use. I will present some conceptual groundwork. In place value we will go through ones, tens, hundreds, I don't just ignore it. I simply won't spend all week getting ready to teach the skills, because I have found this: you can go through it one day and they can work out this long expanded notation and the next day you can come back in and represent the identical same page and they still would not be able to figure out what the parentheses and pluses across the page mean. There is not much difference in our opinions as teachers about this business of working with level 3s.*

More often than not the child in level three is Mexican-American or Black. The kids who can't or don't get it are the bane of the mathematics teachers' existence. Mrs. Harding said:

> *Slow kids are unnecessarily penalized in math. Slow in their actions but solid in their math is bad news. They get hurt. We can't increase their speed by snapping our fingers. The mountain no one, I mean no one can climb is how do we get the needed drill without boredom? That is the question in junior high school mathematics. We need an activity workbook filled with practice ideas for each grade.*

Her view is not with the majority, which is more one of seeing the kids as not trying.

> *If I had to put it into a nutshell I'd say these kids are lazy. They have the ability, many of them. I don't know when it begins [laziness] or how it develops. (All three agree.)*

In an unusually redundant vein, I offer an extract from an interview with three other math teachers:

> *We shouldn't call it ability grouping. It is performance grouping. The reason most of the kids are in three is because they are lazy. We all know we use but a fraction of our ability, you know.*

An algebra teacher saw it as an interaction of disinterest and unnecessary confusion.

> *Here's the problem in a nutshell: we are teaching them why we do what we are doing and fundamentally most of them are interested. The thing they never get in the first five grades is one method that works. So, I teach old division, not what the book says about the new mathematics.*

Others echoed the complaint pointing to the textbook as a primary source of their problems. One sixth-grade teacher has simply quit using the textbook because:

> *It confuses the kids. Long addition problems involving expanded notation which confuses the kids more in the explanation--the kids spend considerable time and can't figure out what they want and never do get to the skills. Now I have an individual card on each kid. Diagnostic tests to see where each one is and practice on the four basic skills. I am using the rote method pretty much because they have found out that with a three level you can spend all hour trying to get them to understand [and they can't].*

The district has sought to regularize its instruction in mathematics through the development of a curriculum Guide. It has had department heads and select teachers working on behavioral objectives which correspond with the content of the texts. To these are added resource materials owned by the district or available through an inter-district cooperative. One teacher more strident in tone than most said it for the faculty when she discussed behavioral objectives as "minor perturbations" in the big picture.

Standard practice that is widely averred by junior high math teachers as successful is repetition. I saw it in use daily over all grades--but less so at the upper (zero and one) levels. One articulate teacher who was acclaimed as very successful says it this way:

> *The key to mathematics teaching and learning. In fact it's through repetition that concepts come through to many of our kids. It is not a matter of concept teaching vs. drill teaching like the colleges would have you believe. Some kids cannot get the concept any other way except through drill. That is the weakness of contracts. Kids rush through their work without the necessary slow drill they need to have it sink in. Their concern is, "How fast can I do it?"*

What's The Big Idea?

I asked a dozen math teachers to give me the big picture of mathematics, to tell me what it was. These teachers represent nine or ten of the group:

> *Everything you do in life, everywhere you go in life you will have problems and we teach problem solving. And you need a procedure to solve problems.*
>
> *Preparing them for basic algebra in high school [by teaching] rational numbers, basic geometry and exposure to trigonometry.*

"Learning to think" is what mathematics teachers believe children get from math when they are successful. Whatever their pedogogical emphasis, a vast majority have their eye on a common outcome: "clear thinking" as demonstrated by solving problems. Three math teachers each with five or more years of teaching mathematics chatted with me in the lounge one morning and here is what they said:

> *I give half credit to students whose work is correct but who do not use the right method. [Another teacher says] The method is important. A lot of times they may be able to figure out the answer; but if they don't know the method, they may be able to figure out the answer but they haven't really learned anything. [The third offers] They haven't learned how to set it up because most of the problems they will have in the future they must be able to set it up and work it through a certain method. Being able to think is developed by being able to set it up, to work it out. There are some times when more than one method is possible, but that is rare.*

> *The weak students will spend more time trying to get the right answer from someone else, or from some other way than working the one problem themselves. I stress that you work on as many problems as you can and I'll grade you on the number you get correct. If they can work five of them slowly correctly, great.*

During that conversation one of them described a phenomenon that should interest those who puzzle about how children think:

> *We have a few children in math--I have every year--that can take a problem and figure out the answer and never know how to put it down. I think there are children who really and truly can sit there and think and can figure out the right answer and that's the group of kiddos that bother me. What do I do with that group of kiddos? Do either of you know what I am talking about? I had a child who could get that close on any percent problem; but I never could get him to write it, I never could teach that child. I didn't know how to unlock what he naturally had up there. He was so far ahead of me on that and yet he could not work any problem completely and yet he could give you [snaps her fingers] that quick.*

I asked what the big ideas were for students in eighth-grade mathematics assigned to level three. A teacher of many years said:

> *Mastery of one basic operation that we usually get in the second through fourth grade. This year I have more Mexican-Americans than I have had before. Basically 3s are Black and Mexican-Americans. But it makes no difference to them that I am White. Teacher race is not an issue. It makes no difference.*

The simplest response I received was from an "old pro" who confided:

> *I've been there for over twenty years. What I have helps but it isn't good enough. Almost everything is way over their heads.*

I asked about the matter of what the parents expected of children in level three:

> *Black parents' expectations of their children? "Sit down and let well enough do." Those who don't need to come to open house, come. Those who send back their signature really need to, but don't. The homework is not only difficult for their children--but for them, too. They just aren't with it. The school knows that. It is an extremely difficult problem and the interest is not there to study it.*

A teacher who is highly regarded by her colleagues is amazed how children learn mathematical abstractions at all. She says we concentrate on the child who fails when it might be better to find out how one succeeds.

> *The quiet child, doing so well, probably wonders if that is all there is to learning mathematics. He wonders. His teacher also wonders and works with the poorest students.*

But no wonders are worked.

Competition and Mathematics

Competition is widespread in River Acres in junior high mathematics. It is one of the things "that works." I asked a group of teachers what worked with any regularity in teaching average or below average students in mathematics:

> *Sending kids to the board. It's fast, diagnostic. I can screen and check on many kids in a short period of time. I believe teachers' colleges underestimate the value of skillful board work. In ten minutes I can get what it takes three hours of testing and grading of papers to uncover.*

Another articulate teacher who uses competition in her group math games saw it as having:

> *One serious unfortunate consequence: the student looks to others to see who he is. He should look to himself. Testing has the same outcome.*

Grades run a close second in the "what works" category--even for the lowest level.

> *For many of the kids the grade is the only thing that challenges them--particularly the upper levels. I have half my level three class that is not turning in their work and the other half turn it in only for the grade. No grade, no work.*

Grades and competition are combined by some math teachers of level three students. There is competition.

> *For an individual's grade--not to compare with other kids. That is an upper-level kid that wants to compare. Sometimes a level three kid will work to get out of level three. The grade is the one thing that really works. The only other really good motivator is to get the kid up at the front of the room in front of their friends; they will perform. If you can get them up at that board . . . any kid at any level . . . you have got half the problem licked. They will be motivated to perform. Games and puzzles will work, too, but we do not have enough such materials! Fun things to do.*

One department head said that competition was one useful approach with mixed blessings.

> *I like the idea personally and I like it in the class setting. Lord knows there are many facets of motivation and this is but one. But it is one that on balance gives positive direction, then I saw it is worthwhile. To the extent that it turns some kids off so they can't ever compete, then it is horrible for sure.*

A serious problem in the eyes of counselors and teachers occurred a few years back when counselors noted students commonly were observed to have standardized achievement math concept sub-scores in the nineties and computational sub-scores in the forties. This is charged to the bill of modern math. For the past three years, teachers have been consciously working on computational practice. The school's criteria for placement in instructional levels are not written down, but they are known.

> *First: standardized test scores. Make no mistake about it, when things get hot and heavy the tests count more than everything else put together. You can shut anyone up with a test score: a parent, a superintendent, another teacher. If there is no standard test score then it's the teacher's word. Anything else comes last. The big "except" is a powerful parent: that's five aces.*
>
> *Every opportunity for a fast student to go as far and as fast as they want to in this system. The problem is not with opportunity but with our wisdom in using it. We have too many kids not ready who are in pre-algebra. Not ready emotionally, not ready intellectually. Too much too young. So we skip the sixth grade. There will not be that many ready to take algebra in the eighth grade. In math we let kids cover the sixth-grade book on a contract basis. What I find is the kids' main purpose was to finish it fast. Rushing through was the main purpose. So I switched over to one textbook and started taking it as a class rather than on individual contracts [moving through book at own pace]. The fifth-grade elementary teachers overestimate the ability of the kids' readiness for pre-algebra. When I check their achievement scores, sure enough, they are below nineties [percentile on SRA Math Test] and eighties cannot do pre-algebra work.*

Counselors say the honor of being in zero pre-algebra is considerable: "Kids can struggle beyond their competence to get in, and stay in, this group. Prestige is high." But not every teacher can be so honored. A long-time math teacher who is regarded as a successful teacher of the 3s confided that she longed for a chance to work with top-level students: "I have never been given children I can show anything much with by way of achievement."

I spoke with several junior high math teachers who prefer to teach the pre-algebra sections. One said she prefers to teach seventh-grade pre-algebra math sections because they are more math-concept oriented than are the sixth-grade sections which are more skill oriented. Only a few can really understand the use of rational numbers. She does think that modern math's emphasis on the use of correct terminology is a big plus. (This constituted a rare instance of a teacher or administrator saying an encouraging word about modern math.)

It would be safe to say that the "zero" sections or the pre-algebra classes in the sixth and seventh grades are the "darlings" of the junior high mathematics curriculum. One teacher who has taught the zero group is not sold on the idea at all. She raises provocative issues. She would like to teach pre-algebra to a randomly selected group of students to see what would happen.

> *If you will look at what happens here you will find that those who take the three-year pre-algebra course are not cutting it in high school. So what would be the great loss then? These zero kids are doing without eighth-grade math and they can't cut it in algebra without it. They take sixth-to eighth-grade math in two years and pre-algebra in the eighth. All but a handful of kids, who would have learned it without our help, just can't cut it in high school. They stub their toes in geometry and can't take Algebra II. The eighth-grade math in decimals, fractions and the like is what does it to them. They miss them, and they are required [to be successful] in Algebra. Another thing, it is forcing logical reasoning too early on the kids. They just don't for the most part have the logical reasoning capability at eleven or thirteen to handle that pre-algebra.*

Another teacher touched all the issues related to instructional grouping in his response to my question about his feelings regarding levels:

> *It is quite effective as it stands. I could argue the other way that the good students could help the poorer students if we did not group. We are just used to having kids grouped. It could be done another way. Any way has inherent problems. Now, a kid from a higher socio-economic level that gets thrown into a lower class, there is often pressure to pull that kid out, not because of the content of the material, etc., but because of the social class distinction, or race or whatever and that's a tough problem. Tough. Our grouping is far from perfect. Nevertheless, it is convenient for the teacher and for the kid. At least the kid is going to compete with kids in the same ballpark, so I favor it from that aspect at least. Grouping is imperfect. We don't have our criteria spelled out. The way it works is when a kid gets placed at a given level, the system's inertia and parental pressure act against his being moved downward. We need a better device for facilitating movement between groups. If it could be devised, groups would be fantastic.*

It is difficult to shift a student from one group to another.

> *There is very rarely a period in which all three levels are scheduled. This precludes shifting a student from one level to another, since his whole schedule would have to be rearranged. Very often it simply cannot be done, even if we were willing to try to do it just to change one class level. We set up one textbook with the other textbook sort of intermeshed. For one kid to move from a low level to the mid-level is tough--especially in the middle of the year. Different*

> *textbooks and different pace through the books by different teachers--a conscious decision we have made to not force page-by-page uniformity, skill-by-skill progression--makes us give up the flexibility to move kids up and down.*

The picture is more clear and the results understandably more satisfying at the other end of the grouping spectrum. There is a "zero" group in mathematics which has been already identified as a source of teacher, parent and student pride. Upper-middle-class parents virtually demand the placement of their children in "zero" according to several teachers. It is a "pre-algebra" group. These students are identified by standardized achievement test scores and by fifth-grade teachers' recommendations. The junior high counselor then places a promising student in the zero group. There are "misplacements." The counselors report that about five students a week stop by to say "math is too hard." Mathematics classes are the chief complaint of the students. It is not seen as a serious problem. "Sixth-grade teachers come by and check a student's math [achievement test] scores --never their elementary school grades."

My favorite mystery story in River Acres came up again in the junior high schools a couple times. (It was not mentioned in the high school.) This time it appeared in the context of a discussion of a pre-algebra class I had observed.

> *In a pre-algebra class all you have to do is run through a diagnostic text with them to make sure they hadn't missed a skill, like division--if they had slipped in that, had not gotten it clear, they've got to have those skills. Then you can move on. The need for continued repetition with them is not there. But it is with a two and one level student. They understand it when you go through it; they understand it that year, that month, and the next month it slips out. The fact that they work through it successfully one time and work all the way through it again greater insures it . . . it's a matter of having conceptual maturity or cognitive skill. When you have it, repetition is not necessary; when you don't, it is. In fact, when we mis-test these pre-Algebra I kids and push them before they are ready, we could be stopping them from learning what they would have if we had started a year or two later. They are in zero and learning to dislike math and could be loving a good level one math course.*

There were no mysteries to behold in Westland social studies: issues, pathos, and humor, yes.

Westland Junior High School Social Studies

The social studies in junior high school are the summation of three courses: world studies in the sixth grade, geography and history of Texas in the seventh, and the first year of a two-year required program in U. S. history in the eighth grade.

In Westland the students do "packets" or short instructional modules created at the local level. Little use is made of textbooks in many of the social studies classes. It is a "way around the reading problem" for some; and an indictment of the text for others.

> *The eighth-grade text does not meet the needs of anybody. It is about college level. The society in which we teach dictates the use of a textbook, however; so, even though I don't use it in class, I send it home every now and then to keep my parents at bay.*

There are other problems associated with the use of instructional materials. Scheduling makes it difficult to catch up if the child misses hearing a cassette, for example.

> *If my student is absent when the first cassette in a series is in the room, it is quite likely he will never hear the cassette. If the second cassette builds upon the first, too bad.*

Depending on the informant, packets represent either "stuff we have been using for years, but now redesigned into packets," or "a new approach to the teaching of social studies." Regardless of the informant, the packets apparently were created at great personal time-cost to the teachers. The packets are not the outcome of the aforementioned district curriculum guide project, which was roundly panned by a majority of the teachers as a "waste of my time." "I should be spending time preparing to teach rather than writing those curriculum bulletins."

Each packet completion signals a packet test. Packets usually take two to two and a half weeks to complete. Students told me the test questions were all easy: "Except for a few [questions], they are straight out of the material." Tests are interspersed once a week for the level one and two groups--not for the 3s.

> *We test them less. We give them credit for just having done something. By now we have seven grades for level 3s and about thirteen for level 1s. The important thing to understand is we have to give them something . . . like to color an Indian or vegetables that the Indians gave the White settlers who came to Texas. And if they do a half way decent job we give them an A, which is hard to get.*

I do not believe this teacher spoke facetiously. She spoke nostalgically of last year when they had four levels and the year before when the district had five. Again, the counselors examine tests and grades to determine the placement of the students in social studies.

A kindly word for behavioral objectives was heard in this setting. "When they [behavioral objectives] let the students know what is expected, they are good. My filing cabinet with my unit-by-unit objectives can be easily moved, reorganized."

This teacher continued to say that the same could not be said for the Curriculum Guide which he worked on. "Once it gets set, it is not as flexible. Printed means finished."

Open Space

Open space is a tolerated rather than an enjoyed feature of social studies instruction. The prevailing view is that the district administration decided on the open-space architecture and they had to plan within that concept. But two young teachers said that open space means no discussion in class. When class discussion is tried, the arm-waving, laughter, and oral disagreements have the potential to distract over 200 other students not involved. The good news about open space is that the students can see that all the other teachers cover the same content that theirs does. "It shows them we are not being unfair."

What's The Big Idea?

There is quiet disagreement among the staff over how much of the social studies should be geography, factual history, and how much should be the study of man and his environment.

The only junior high school social studies teacher in the district that I saw approaching what could be called a controversial topic had this to say after class:

> *The teaching of man's relation to himself and others necessarily brings up religious, political, sexual, ethnic, social, racial problems and deals with very touchy subjects because of what shall we say, the Bible belt? The Bible and the religions of certain groups in certain towns who will forbid--who think these should not be spoken of in public. If you mention certain things to certain students it goes home and the school board gets calls about it: "Why are you teaching my child about sex?" or, "Why are you telling my child about this particular church?" You learn to deal with this by learning that this is not what the community wants so we don't do it. You have to survive in the community in which you teach. They are paying you your salary with their money, so basically they have the right to a degree to keep certain things out of the school that they strongly agree should not be there.*

The latter represents the minority view of this faculty. For that teacher who also said, "The social studies we teach is the dead corpse of past knowledge, not the life of man's thoughts," there was a quick-draw reply: "Yes, Hal, you would trade off the history of Texas for a classroom bull session on sibling rivalry."

Instructional Levels

A problem shared by most on the social studies faculty is a now familiar one to the reader: what to do with the level three students? "A lot of the sixth grade students in level three were passed on last year with F averages. I have them again this year. This is not a boy-girl thing. The same rotten attitude is shared by all of them." An administrator said they were, "Willing to turn their level three students over to elementary teachers of reading and arithmetic and [let them] give them a grade in social studies. It's hopeless the way it is now." He continues:

> *We strive to provide something students can sink their teeth in--at least the average and above average student. We are still far away from helping out slow learners. They are never going to use a good portion of what we give them up here. The whole program has to be geared away from history and more to learning about self. How can I get along in the world, with the fellow down the street, with my fellow students. There is an overemphasis in the entire curriculum regardless of level on factual history and factual geography. The basic facts we try to pump into kids--they could care less. "I've got a lot of history in my own attic." Kids are delighted to learn that they have at home the stuff of which history is made. I have a deep, closer relationship with many 3s than with 2s and 1s, even though I supposedly do a better job with them. . . . We should take these poor students away from social studies and teach them to read. It is better to help them to read first than to sit up here and be bored silly.*

Teachers team teach infrequently in this open space setting. One informant, a teacher of several years, said they did teaming last year, and:

> *Decided during summer not to do it because teachers felt they were not able to put their "individual stamp" on their classes. Also, they were unable to tell who got what from whom. Two classes were combined for two teachers with sixty-five to seventy students. We never did get to know their names. The open space area is unfair to the students. A lot of average to below average kids cannot handle the distractions. [It is] less of a problem for group one students. They seem able to block out noise, other teacher's directions to their classes.*

General Practice

I asked a group of four seventh and eighth graders what the social studies were. They described what they were doing in their class that week. I pushed on, and the group agreed to this as their "final report."

> *It's something you gotta know. When you get older and some people ask you a question about what happened a long time ago, you can tell them. [Also] What different countries are doing. History of what people have done. Also, the history of places, and climates. How people get along together, their relations.*

I felt like one teacher was really talking straight with me when she said:

> *We have many more Mexican and Black kids in three level. Very short attention span. [Pause] Self control is horrible. [Level three is the lowest in social studies.] They don't have the pride to give them the motivational drive. It is not that they are lazy. They just aren't proud of their schoolwork. So we can't give them reading. One-third of the 2s do their reading in class or their homework; about 5% of the 3s do anything. Now a lot of these 3s go to California or Mexico in the summer so they do have money, which is saying a lot for a 3 because I haven't been there myself. They think mommy or daddy or the state is going to support them all their lives. I tell them that it is a dream; that they have to start taking pride in something. Even if they are going to be a maid or a cook --and I try to say this in their own language so they can understand it because I say some words they don't know--whatever they are going to be in life at least be the best. Slashing the meat patties in McDonald's or what.*

The in-migration of students is creating a particular problem for the seventh-grade curriculum in the social studies.

> *Texas geography is emphasized in this curriculum. Because most people are not from this area, it is difficult. They like it least. Those children who are Texans, have relatives here, like it most.*

A little Texas humor was shared by this informant when he reminded me that:

> *The Texas Constitution guarantees [us the] right to subdivide into five states. They don't do it because they can't agree on who gets the Alamo.*

The big problem which underlay the obvious student apathy toward the instruction of Texas history was nicely phrased by a young teacher:

> *The weak students don't care about our Texas history [pause] and the bright students really don't care! [He went on to say how important it was to relate Texas history to daily lives of kids to better motivate their interest.]*

The following excerpt which begins Gerald Haslam's Tejon Ranch captures what some social studies teachers in River Acres wish their students would appreciate about the local history about them.

TEJON RANCH

Por Ramon Dominquez

An old cowpoke laments:
Today, driving freeway
fast past ranch, racing smog
to smog over scraped and
shattered hills, vivisected
valleys, my weary eyes
scan, pan arroyos and
canyons of my youth. Gnarled
oaks: saplings of my sap
days. From my grandson's sealed
and certain car, I gaze
far away, arrears, years
gut gone.

Gerald Haslam

Although it was not uttered for this purpose, advocates for curricular uniformity would find ammunition in the view of this social studies teacher of several years.

> *I believe that "social science" suggests too exact a subject [for what we do here]. It is often pretty much a matter of [teaching] one ideology against another, without exact evidence to prove which is better.*
>
> *It depends on who is teaching [the section]. Eight different people mean eight different social studies curricula. We don't teach Texan history the same way in Houston as we do in Amarillo. Don't let anyone tell you different. The changes are subtle and very, very important.*
>
> *We teach [students] a lot about the several things in social studies: geography, history, anthropology. But we do not help them to learn to get along with each other and that's social studies, too. I am put in a dilemma. I know what the Curriculum Guide says. I know that Austin requires me to teach so many hours of this, that and so forth--or you might get state funds cut off from you. But my heart is not in teaching seventy-two hours of Texas history. I see Texas youngsters who need help now in things that Texas history cannot provide. I am cutting my throat when I say that, I know . . . it's a dilemma.*

In my final interview at Westland I got what I deserved. I had asked a group of seventh graders what the social studies were and understandably was getting nowhere. I asked what a social scientist did and one girl said, "You should know, you're doing it."

I cannot pull all this together for the reader or myself. Westland science, mathematics and social studies are not together in the minds of the students, the faculty, or the district curriculum writers. They are separate aspects of school instruction. Best leave them that way. On to Eastland!

Eastland Junior High School

> *Be careful . . . I could get mixed up. Same building plan as Westland, another charismatic principal! Crowded? Shacks in back for overflow. Just opened.*

Eastland was still getting itself "grooved" during the period of this study. My aforementioned notes reveal I may have been unduly sensitive to the importance of this fact. I saw understandable differences and sameness in both junior high schools. For sure the Eastland faculty did not appreciate the student overload. They said "crowded" to me again and again. They were less convinced than were elementary teachers about the merits of open space. Interestingly, they provided the only instance of continuous team teaching that I observed beyond the elementary grades. How much of what was said and done should be ascribed to the "new building" is unclear to me. An administrator admonished me early:

> *Don't forget in your study that we just opened this school. You can't appreciate the social problems of opening a new school--especially if it is built to defeat you [open space]. Next year it will be better: less planning, more practiced.*

The lively "Good Morning" of the Eastland principal preceded the day's reading from the Bible over the intercom. The student continued with the Thought for the Day, an aphorism on friendship. She wrapped it up with a brief devotional statement. The principal announced last night's winning varsity score, the losing junior varsity score, reminded the teachers of something, and turned the day over to the listeners.

A potential listening audience included 89 professional staff with aides and all totalling 107. The main building was created for 1650 student body maximum. Now the school has 2025 students spread over the main and eleven temporary buildings ("the shacks") which house the sixth graders. There are roughly 450 students of Mexican-American descent, and 175 students of African descent in the student body.

I had a long talk with four eighth graders about life at Eastland. They like it, "about as much as you can like school." They talked about school, homework, parents and self.

> *You hardly have any in social studies unless the class is bad. I bring home science everyday so my parents know that I try. My mom and dad think I ought to be making a straight A. I go, earth science is too hard for me, I can't do it. They say I can if I try.*

Except for direct interviews with a dozen students, I learned most of what I know about student life at Eastland (and Westland, and Central High) by talking in the bus lines and over lunch in the cafeteria. The time-honored hyperboles were used by them to describe their condition.

> *It is like a TV prison movie. You sit there waiting for the warden to blow his whistle to let you go. Just about the time you get out of line, sit down to eat, they blow the whistle.*

> *We got more privileges last year. In lunch we used to listen to the stereo but we can't now. Any little thing and you get put in detention hall or you have to clean up the cafeteria.*

This school and all River Acres schools are under strict control. The prison metaphor is not apt. Rather I am left with a sense of old-fashioned orderliness. Some still do have that vestige of the fifties in their schools, and River Acres is one such place.

I worked at a cafeteria table within earshot of hundreds of kids for periods of fifteen to forty-five minutes over a three-day period. I did not hear one "X-rated" four letter word in that time. The girls dressed so maturely and stylishly: pants suits, fine sweaters and dresses, hose. Boys in leisure suits were seen from time to time. The "excuse me" and "pardon" were too frequent to count as we encountered one another moving through the hall. The obvious social courtesy of these youngsters impressed me.

The old-time sense of the rule, respect for property, authority and self will be treasured by some readers. It may be that the forces that keep this intact also act to insulate teachers and administrators in River Acres from other national trends. All this and more can be seen in our first testimony on science instruction at Eastland.

Instructional Levels

River Acres teachers, administrators and counselors not only believe that grouping for instruction is practically the only way to go, but they believe that they have evidence that it makes a difference how you do it. One junior high counselor commented on the movement from five to four to three performance-grouping levels over the past three years.

> *Kids that were rebelling are now passing, doing their work. They now have audio-visual work for combined classes. One math teacher was in the area with her level three kids. She took them out to the temporaries. They got worse. She believes that they lost peer control.*

In another instance, a counselor and faculty member's remedy was to move from three back to five levels.

> *When the six-week report showed forty-five to fifty-five failures in science in each of the sections in eighth grade, she called them all together. They decided how to remedy it. They took all the level 2s and pooled them during the periods they had common sections, divided them into high, medium and low sections. We got new rosters and began anew.*

There is no performance or ability grouping in the elective areas K-12 in River Acres. Obviously there is self-selected ability grouping as in team sports and orchestra, play productions and the like. I talked with three seventh graders about science one morning before school. They said that levels were "okay."

> *The problem is learning which teachers like which kinds of answers anyway. Some want them exactly from the book. If they aren't [exact], "That's sloppy thinking," says Ms. X. Mr. X says you really don't know it if you can't put it in your own words. Now, Ms. X is right because just any old words won't do for telling about, let's say, atomic stuff. And Mr. X is right because when I really do know it I can say it in my own words. But it is all mixed up and it is hard to tell sometimes which is right, which is the right way. So you better know what the teachers' answers are or you will get graded down a lot. [Q: Do all the kids know that? Unanimously, "All the level 1s do."]*

I heard from several different students in several schools that going to the counselor about levels was "a good way to get out of class" (the counselors said that did happen). Students go to counselors for electives and teachers go to the counselors for the basic subjects. A seventh grader said:

> *The teachers want you to be in the right place. Most people who are in the wrong level get changed. Everybody is about right where they should be. It all works out right.*

An administrator in the district office summarized the importance and functions of levels for me during my last day in River Acres:

> *I am proud to have a system that groups on performance, not on aptitude. In the ninth grade the aptitude tests would suggest we have a 50/50 split in mathematics--but it is 75/25 girls over boys. By the time two years pass, it is reversed. Motivation, not aptitude, is the reason this occurs. Kids, particularly boys, get bumped down a notch [level] if they are not motivated. We find this mainly to be true of boys. It's got to happen [this way] where we take a hard line on homogeneous grouping with the teachers having a heavy input [in the grouping]. One problem is that kids may sandbag to get down one level below their struggling level.*

Open Space

A panel of eight junior high school students (representing no one other than themselves) told me they would vote to:

> *Get rid of the open concept, especially in the mathematics area. Wherever you read or have to concentrate. You really don't have to concentrate in social studies so it's okay there. [All agree] And whenever you have to sit in the back of a noisy class and you are closer to another math class than you are your class, it's hard.*

I did not ask the sixth graders their opinions since they were instructed principally in the temporary portable buildings, but a precocious seventh grader who had been in open space "only for a couple months" shocked me and her teacher when I asked her how she would describe open space in Eastland to a friend that had never been there.

> *That's when a school has separate areas for the teachers separated by blackboards, bookcases and things to make it look like a regular school. Since there is not many doors to separate areas, we can go practically everywhere without going through a door to get places. I don't like it for reading. The noise gets to you especially in RWS.*

Other students said that they had been in it for over three years and it did not bother them. "I guess I just don't notice it very much."

My impressions are mixed as to how well the students like or dislike open space. I found students who had been in it for several years and liked it and others who disliked it. I found students who liked and disliked it in their first semester. Similarly I found no pattern associated with students of level one, two or three. The issue is clear for the child who needs or treasures quiet space. "At home in my room I can get a lot more done. Some other teacher is forever yelling at someone in their class and that bothers me."

The chief rival to open-spaced grouping for conversational leadership among faculty is the correlative matter of basic skills instruction. An administrator who had taught for several years in the district offered his rough and ready estimate of what is confronting junior high school teachers in the district.

> *Fifty percent of our children have a fundamental problem or set of problems in a basic skill area. It is almost always reading or arithmetic but it shows up in science and social studies, too. I'd say 25% of the students cannot read any directions of any sort, and I am being conservative. I would also have to honestly say another 50% will not. If you could solve the problem of reading and following directions you could be the governor of Texas.*

Before discussing the science curriculum in Eastland I should like to close my introduction with a pointed reference to a wicked, four-second, E-flat dismissal tone, which I suffered daily at Eastland. That, I shall never forget.

Eastland Junior High School Science

Teachers believe there are sweeping changes underway in student attitude toward school, its work, its importance. I discussed this as the "New Crop" earlier in this report. They see the first waves as having hit the beaches in science with larger ones looming off shore.

> *We have lost our work ethic. School is for entertainment. Parents, teachers and children have lost appreciation for education. They want to be rewarded for performing any kind of work. Rewarding effort no matter what the quality of the product is a part of it.*

When this perception is added or melded with one of increasing parental and administrative pressure for achievement (manifest in good grades by their children), the teacher "gets a bit anxious." Evidence of an attempt to "do something" about the science curriculum is on hand.

The science curriculum experiment of 1976 discussed in Westland Junior High was also attempted in Eastland, wherein all science teachers taught all grades and all science curricula. The same results were perceived by Eastland teachers: poor. "I stumbled through it . . . We were so thin in our preparation that we did no justice to anyone." A fair representation of the faculty's view at both schools--this one by a teacher with more than ten years in the district.

Another sixth-grade teacher said, "It revealed to us all how weak many of us are in physical science, chemistry, physics; and our textbooks don't help a bit. . . ." This should not suggest to the reader that the faculty is seen by themselves or by the high school faculty as weak. In fact it is regarded as strong and getting stronger. The overriding issue at Eastland in science instruction is crowding: "We have three kids for every lab table where there should be two. Forget the 'hands on' stuff; it forces us into tell-and-show demonstrations which we call laboratory work."

General Practice

The science curriculum is general science in the sixth grade, life in the seventh and earth science in the eighth grade. (Earth science is seldom taught beyond the eighth grade in Texas.) In all three grades teachers say their "average student is at grade level." The classes tend to be larger at the top (the 1s) with roughly thirty-five students per section, growing smaller in the middle (around twenty-five) and smallest at the bottom (one had seventeen). The sixth grade has almost all laboratory work. The seventh has four groups in an area with laboratory space designed for two and the eighth is in similar shape. (The laboratory tables are rarely used under present conditions, nor are the audio-visual materials.)

The district has a good record in the teachers' eyes about supplying equipment and supplies. But once they break down, that is the likely end of their utility. During my stay teachers were trying to figure out a solution to the problem of using a bioscope screen. There are no shades on the building windows, and a mis-wiring of the building means turning out lights in one corner of the section would turn them all off. One of the two AV areas in the building designed for general use is a detention and study hall room. Teachers do not feel distressed by all this. I asked about their use of the resource center for science.

> *A laugh. Two [teachers] have requested materials to enrich the science library. They have requested books and none have been purchased. Encyclopedias they have. Have you ever looked in one? Way too hard for sixth graders. I can't even find things in them. In general, the resource materials are scarce; and when we have them, they are too difficult for the students.*

Another made the distinction for which science she was teaching: "Library? Okay in life science but weak in earth science. Library has stuff which we don't know about. No communication to us."

And a third teacher offered the antidote for her resistance: "My kingdom for a science dictionary. That could get me to [use] the resource center."

Not with an eye to overkill, but because it is so, the story on between-grade and between-school articulation in science is no story at all. There is latent interest in changing that story.

> *We never meet with the science team leaders in the elementary school. They should be teaching some of these concepts. At the end of the year we meet once to select students for their honors classes.*

And another teacher suggests:

> *Surface [was] just scratched in curriculum coordination in life science because that is where our eighth graders are headed immediately [ninth grade biology].*

A further suggestion was heard, local in character, but it could be heard as a plea for help nationally.

> *They care less and less about their grades, about passing [to high school]. But it may be a change that comes with a growing area rather than the times. Frankly I can't get to some of these kids. I don't know how to do it. If there is anybody who can help me get there, have him or her come on out, I'll take the first ones. This must be all over the United States. I'm sure it is not just this district.*

Earth science has the greatest number of student failures of any junior high course in River Acres. Teachers say this is because it is less descriptive, more conceptual and process focused (not in pedagogy but in understanding processes). Input in nomination for students' least favorite subject in the junior high school: physical science.

A former science teacher, now an administrator, offered the interpretation that earth science problems are understandable because earth science emphasizes process and is less descriptive than biology. "Teachers must become more aware of teaching process; something beyond telling students 'This kind of crystal structure exists because. . . .'"

The wide range of earth science content is generally accepted as a facet of the shared agony of teachers and students alike. Teachers need help. Students say, "Only the geniuses can get it." Counselors' and teachers' assessment of what consitutes the instructional levels in this course do not agree. The instructional materials are often reported to be "inadequate or mismatched for all except the level one kids--and even too difficult for them."

Instructional Levels

The story is similar to the one told at Westland Junior High School. The top-level students are generally appreciated by the faculty and the "do-do's" are the bane of their existence. Nearly all the faculty want more (rather than fewer) levels.

> *We all prefer four levels to three. The "bad-news 4s" could be isolated [for reading instruction]. Now they contaminate. [All agree that their special regrouping system vitiates the levels.] On occasion the counselor will send us 1s at the year's start and we pre-test them as 4s. It shocks the kids.*

Another teacher with her eye on the 3s said: "We need a verbal-oral/listening biological and physical science curriculum for non-readers."

Open Space

Open-space architecture is seen as useful for warehousing the extra numbers of students but not without paying a price. The necessary absence of carpeting in the science area, for example, adds to the inherent problem of noise. "One time I yelled at a kid for talking too loud and it was Martha!" should give you an idea of what the teachers think about the noise level. On a particularly noisy day an instructional class can be at the level of the cafeteria, but it did have a different feel to me as an observer. I asked a teacher about this difference I felt and got shot down with, "Yes, you have a fine ear, Mr. Denny; it's the difference between a yell and a scream."

No one in the district teaching at the junior high school level had formal training in working in open space, nor in team teaching. One science team teacher said the situation "pressed" them into team teaching. "Better to go crazy together, than each alone," joked the young leader. They are committed to continuing it, "Even when the new junior high opens and the numbers [of students] go down." They say it is no panacea but clearly preferable to "going it alone."

> *We're trained in four institutions in three states. . . . Feel guilty about missing a day of school if you are letting your team down. Loyalty. But if you have to, the substitute can get real help from the team. When one of us is weak in an area we can shore it up. Our tests are so much better now that we are doing them together. [The team is cross-sex, bi-racial--but all young.]*

Team teaching in open space junior high school with fixed class periods is an enormously complex activity. Activities like showing a film a second time, or extending an activity for an extra period, or following a personal hunch when the teachable moment presents itself are difficult or impossible to do.

What's The Big Idea?

What is science? For kids it is either "animals and plants plus some math" or the course they are currently taking plus a dash of space and "laboratory experiments like on TV." For teachers I found no universal theme. A couple saw it as the last chance to give kids an understanding of the earth sciences. "They will never hear of it after the eighth grade." For another it is the representation of what scientists do. For two others it is a blend of "about 50/50 inquiry procedures and big concepts." For three teachers of widely ranging experience and who teach all three levels it is a matter of covering the fundamental concepts in the textbook, be they life, physical, or earth sciences.

As was indicated, the earth science curriculum has the greatest number of student failures, about which there is faculty and counselor contentiousness. The biggest science content issue presented to me in the grades K-8 was in earth science. One old-timer gives the historical background.

> *In the old days when we were much smaller we were much more relaxed and did our own thing. Now we cannot do what we like best. The pressures from on high are mounting and we feel them. . . . These pressures are supposed to be "content" but they are more "how" and "when" pressures. The curriculum is getting more organized so that we all know what we are supposed to do. If I do not want to do something, nobody is going to make me do it, yet. You have to sacrifice something in earth science when you get organized and I believe it is the teacher's pet specialty [where he will try] to get the content covered.*

What he and several of his colleagues are saying is the "big idea" in junior high school science is the subject area you know best.

Instructional Materials

The departmental chairperson talked with me about life as a science teacher:

> *There are only a few places in the United States that I know of that the local districts can select their textbooks directly from the publishers. I don't think the reading level is too far above, but it is above, our very best students. But I don't think that "hands on activities" can be related to concepts by the students. We demonstrate because the equipment was very expensive and we are very crowded [the coriolis force].*
>
> *Last year they stole the ball bearings, went berserk, and played when they did the coriolis experiment. They just made a complete shambles for me. We have to have a very structured lab before they can do anything. They can't handle it socially and they can't handle it conceptually. The best student will say, "Oh, I really enjoyed the lab but I didn't like to answer the questions."*

The reading level of the textbooks in earth science was mentioned as an insurmountable problem. One faculty member told me she knew of an earth science text written at an elementary school reading level (fifth). Since it was not on the state adoption list, it thereby was excluded from use in River Acres (unless she wanted to purchase it).

Another group of science teachers at the eighth grade doubted the claimed grade-level reading difficulty of their text, checked it, and reported the following:

> *The text is on an eighth-grade reading level according to the publisher but we measured it and it is 10.2. All the ones on the TEA list are above grade level and lots of our kids are below level. [Two-thirds of the Texas districts have adopted this text. I wonder if they experience similar difficulties?]*

Several parents of junior high school age students told me they appreciate it when teachers assign homework in their child's textbook. One theme that cuts across parents' views of the school was that of "preparation." When their children have homework in junior high they see it as good preparation for what they believe is to come in senior high. A teacher of several sections of low-level science agreed.

> *Parents love textbooks. It means homework, responsibility, real school to them. They don't know what the kids are doing but they really eat up seeing them bring books home.*

But the use of textbooks in the lower levels is not universal in Eastland. The seventh-grade team--which re-groups the students at the beginning of each unit--does not use the text for the second, third and bottom levels. They hand out notes, packets and rewrite the text materials. They do use the text for the top group, where the competition is "rip roaring."

The Dissection Lab

Teacher-education literature and courses are replete with poesy about the teachable moment, the integrated day, peak experiences, the intellectual quest, and the fulfillment awaiting the dedicated teacher in the classroom. The "Dissection Lab" is more like it, to my way of thinking about public-school science teaching.

The day is a nice one and the apparent interest of the students is reasonably high. Certainly the general attitude is a favorable one. Smiles, friendly conversation and heads turn toward the teacher at the bell. She passes out a dissection kit to each pair of students. In the kit are two probes, one knife, one tweezers and a pair of scissors. She begins the forty-five minute period by asking, "How many tools are we supposed to have?" Many answers come at once and she hushes them by saying: "How many probes? How many tweezers? Does everyone have a pair of scissors? Raise your hand if you do not. How about a knife? Good, every team has five things in its kit. Good." During this time there are several interruptions of sorts. The P.A. system accounts for one--something about a practice that must be attended by someone. One group has only one probe in its kit so she rummages through a supply drawer and comes up with the needed item. Another student does not have an item and then it appears magically. Another group has "stolen" parts of its neighbor's kit. Ten minutes of the period are gone when the teacher can now say:

> *"Let's start the dissection."*
> *"Ms. Marcum, we don't have a knife."*
> *"Good gravy, why didn't you say that earlier?"*
> *"We didn't notice it until now."*
> *"Ms. Marcum, how many props [sic] are we supposed to have?" (asks another student)*
> *"You people just don't pay attention; I'm not going over that again."*
> *"But we didn't hear you."*
> *"Well, start paying attention. The whole group can't wait for you people."*
> *"Albert is already cutting! Hey, Dr. Albert, is he dead?"*

Around fourteen to fifteen minutes into the period the students begin the laboratory exercise and a whole new set of questions come forth. "Are these the questions we are supposed to do?" "Which do you pin down first?" The teacher moves quickly from one group to another offering suggestions, answering the same questions over and over from one group to the next. (She had discussed each of these issues in her introduction.)

The class ends with a nine-minute clean-up period in which tables are tidied, notes are gathered, tools are returned to the kits and students re-group for the next period.

I spoke with Ms. Marcum about the lesson. She is in her third year of teaching. She observed that the lesson was just "about par for the course." She feels that demonstrations work better than does lab work with the lower groups for a variety of reasons. First, the problem of supplies is solved: "Curriculum kits cannot have very many pieces or they 'fly'." Secondly, the problem of discipline is greatly reduced: and lastly, her energy is directed toward teaching rather than "rollerskating from table to table saying the same things like a broken record." She speaks for most junior high science teachers in River Acres when she says, "The mass laboratory just doesn't work. Too much time is spent getting ready (and ending the period) and too much confusion occurs. But we gotta do it."

I told the "Dissection Lab" story to Ms. Laramie. She was noncommittal; listened politely and said, "When you have taught as long as I you get to know what works with kids and what doesn't." Ms. Laramie has taught science in three grades in junior high, again and again. She felt kids liked to do things, not speculate about what they had done, or were about to do.

> *Kids like dissecting earthworms or whatever in the seventh grade. They are very disappointed that there is no dissecting in the eighth grade. That's the highlight of junior high science. There is no sixth grade highlight. Kids like the labs; if they can just do them and not think about what is meant. They don't like that.*

Another science teacher sardonically said what works may not be the "right question."

> *Kids can dissect a grasshopper, an enormously useful skill [wry smile] and can't give any reason why there are no pecans locally [every third year]. They study DNA and RNA and don't know what electricity is.*

I turn to mathematics where the answers and questions of students and teachers were equally forthright.

Eastland Junior High School Mathematics

"It must be Friday. I can hear myself think." So began an interview early during my stay at Eastland. She was saying a lot. I did not know it at the time, but Friday was (is) test day in mathematics at Eastland. Each subject has a day of the week reserved for testing. This spares the student the fate of getting more than one test on a given day in the week. It also assures the teachers of at least one "quiet" day a week in open space. A math teacher not at work at Eastland would have to be one that had expired on the job. "We bust our butt for these kiddos," was said and easily seen on several occasions by the writer.

The department head of the math faculty uses his "free" period to teach remedial mathematics. I saw other members of his faculty working with students before and after school. My notes show a one-liner from math at Eastland, the origin of which I have lost: "The best thing in this district and in this school is people--especially the kids. They are all Mr. and Miss to me. I respect them."

Nagging Problems

Scheduling and crowding are problems to be endured--but not without comment. The scheduling affects teacher behavior. There are discrepancies in the length of the period that cause problems for teachers with multiple sections. The second period is forty-five minutes and the fourth one hour and six minutes. (The fourth period is a split lunch period.) One teacher with two sections of the same class asked rhetorically: "How can you use the same text, with the same math objectives with one period [being] 70% of the other?" The crowding affects student behavior.

> *I used to have five classes of twenty-six back at Central Junior High. Now I have six classes of over thirty. Students know I cannot keep tab. So "advantages" are token. Lack of peer control makes more behavioral problems in the shacks.*

She refers to the fact that the sixth grade is not taught in the main building and believes that peer modeling by seventh and eighth graders cannot have the presumed positive effects it has had in her experience. She could be reflecting the views of a colleague out in the temporary buildings. In general there is little communication of a curricular nature that flows between the sixth and seventh or eighth grade teachers. Communication was cited as a problem by the teachers in a couple respects. First, there is a lack of understanding about central administration decisions which affect curriculum. For example, two teachers said they thought this year's reduction in instructional levels emanated from the Texas Educational Agency. Others said they did not know the criteria counselors used in making assignments to levels. Second, there is a nagging problem of communication between the teachers and the parents. I asked a teacher who had been on the phone for thirty minutes during her free period how effective her calls to parents were.

> *Forget them! My notes are not acknowledged by them. I've never phoned so much in my entire teaching experience. I have not been contacted by one parent in two years to talk about what a child is learning, and I call at least two parents a day.*

She is not an unusual teacher on this mathematics faculty. (Nor the science faculty, for that matter.) Free periods are commonly spent trying to give feedback on student progress to parents of children in levels three and two. What they have to tell parents is not what parents like to hear, of course. It is usually about grades, scores on teacher-made tests, or homework.

Tests

Students in the top and bottom groups often share an interest in grades--more so than do the middle or "average" groups. Kids and teachers share a low view of the standardized achievement test scores. At least in the sixth grade, the desire to do well in school is carried over from the elementary years, as one veteran teacher sees it. "Kids can see more than we measure either by our standardized tests or by our letter grades. The sixth grader *wants* to do more and feels inadequate of what he has not learned. He is mortified. He doesn't need to be embarrassed publicly." Another made a comment on local and national testing of children in mathematics.

> *Scores, scores. Too much emphasis on them. The reason the scores are going down nationally is because of things that aren't mathematics. Lower-level kids fail tests but know much more than we test. Lower-level kids stay in school longer and get tested, they wouldn't have been there in the forties or fifties. The press features results on a paper-and-pencil test designed for the able, abstract, quick child. That doesn't tell me anything about our nation's children.*

I read that quotation as a tease for a group of eighth graders in Eastland asking them if they, "Had teachers in mathematics who felt like that?" They said, "Maybe one or two." They seem to feel that tests, "Show them what we don't know all right."

Instructional Levels

Whether the levels are seen to be working or not depends on the grade level the informant is teaching. At one grade there is a "counselor problem."

> *They aren't working. The teachers' recommendations are not heeded by the counselor. Kids are allowed to switch from level two to three without so much as a courtesy call to the teacher. If I complain I'll get the next ones to move into River Acres.*

At another grade, levels work nicely. While it is true that the biggest amount of student traffic in the counselor's office is math related, "It works out pretty well for all concerned."

That counselor said that for everyone that wants to go up a level, five want to go down. (Boys want to drop a level more frequently than do girls.) This is a peculiar trend in that across all subjects about two in three requests are to go up a level. There is another consequence of level switching in mathematics that is sex related: "Moving a girl down is usually big trouble from the parents." A counselor and a teacher and the department head made similar observations on other patterns of girl students in mathematics learning. The best students sometimes do not like mathematics. While boys who do well in mathematics can be counted on to like it, this is not the case for girls. Some of the highest performing girls have confided to the counselors that they really don't like mathematics. Such comments are not made for the benefit of the boys (who are not there) and are not related to whether they like the teacher(s).

Another teacher said, "I have the feeling after twenty-three years that my top boys understand mathematics better than do my top girls even though they [girls] will score better." (Can't give reason. Not sexist.) Whatever the case or reasons for such interest and/or competence, the lowest levels are populated more by boys than by girls, with a disproportionate number being Black and Mexican-American. There are no student or parental complaints about the concept or use of levels beyond the individual case which is usually settled by the principal, after consultation with the counselor.

The most frequent problems in teaching occur with the level three students--but level two can be problematic, too. A teacher of three years in the district, who teaches level two and three, put her finger on a common problem.

> *When the rest of the children are ready to go on there is no place to put children for remediation; for short term remediation--not a lower level for a whole quarter.*

Last year Eastland had a remedial reading and mathematics program paid for by federal money. This year it is reading only. When the program was in effect, bureaucratic red tape got in the way of instruction for some children. "We had to kick some special education kids out of Title I mathematics remediation [reading/arithmetic] because of the 'no-kids-in-two-federal-programs' rule."

Level three mathematics is often taught a grade, or two, or three below the child's current class assignment. It consists often of practice on the basic facts in multiplication or division with some attention to fractions. Story problems of the garden variety are used when reading skills permit. The best description of the curriculum-in-action for 3s was succinctly offered by one of its clients. "In level three they teach you what you need to know from the beginning. In level two they already know some so they start further on down." Students knew only one kid who went to level two from three; and not one has come down from level one. What's at the beginning of the level two book is the end of the other level three book.

Students frequently dazzled me with what they could tell me about the curriculum, its content, teachers' expectations, and their part of it. How could these children know so much about the levels and the curriculum and be such failures in the classroom? (On the other hand, I recall Mel Tillis never stammers when he sings.)

Teachers feel that the usable portion of the textbook is quickly exhausted in their level three sections. The rest is "theory or far-out things." To cite the limiting case: in one section the week's regimen is text-based on Monday, and it's drill for the rest of the week.

The Curriculum

I have written elsewhere of the district's attempt to get an "accountable uniformity" to the curriculum in the subject areas of this study. They have commissioned department heads, team leaders, and selected teachers to write curriculum guides. These are completed in science, mathematics, and the social studies. Their use by faculty has been spotty. Curriculum guides are an old administrative siren song to which established teachers have long since learned to cultivate a deaf ear. The Guides represent unhappy days and dimly recognizable advent for many. And old timer speaks:

> *Curriculum is a dirty word in our faculty. The twelve of us feel we have put too much time on the curriculum. And most of it is words. We need something simply based. Lots of recognizable everyday applications. Facts and applications have been slighted in our time spent on terms.*

The "dimly recognizable advent" is an accountability procedure underway in one elementary-school pilot program in the district. A mathematics teacher of the top group says she feels the curriculum efforts are more than a guide. "We go by the curriculum because we are accountable to it. That is what is coming more and more. Quarter exams are the forerunner. The probation period for new teachers is a part of it."

Evidence of the spotty use of the Guide is seen in the following comment: "I don't use the Guide. I would rather my kids learn five concepts a quarter than nothing." She feels there is too much mathematics and not enough practice and application in the Guide. Her thinking is echoed by a colleague who teaches only the 2s and 3s.

> *Let's take number base for example [I watched her work with a group on base two later that week]. I am lucky if half my 2s can get it. But they say to keep plugging at it for the 3s. My land!*

The drill and application needs are seen as a cause of the down-shifting throughout the levels by boys.

> *Student-initiated moves to lower levels in mathematics are on the rise. Concomitantly the really hot-shot kids are not being challenged in mathematics. There is more than enough mathematics in the curriculum. What we are short on is applications. The curriculum guides have not visibly improved instruction. In both science and math. Also in both there is a lack of close personal attention in regular math classes and science.*

Another teacher, one with three level three sections, sees the repetition as integral for teaching the 3s and the source of the "hard and dull" label stuck on mathematics by most of the 3s.

> *The redundancy of topics, grade after grade, is built into the Guide. It is in the texts, in our tests. It's in the cards, I believe. We are in a trap. They still don't know their fourth-grade math and they are in the sixth [grade]. Therefore, repeat it. Now you know what the kids say; you saw them: "Oh, Ms. Helene we've had that!" So, we can look good on paper. Better than what we are. The TEA [Texas Education Agency] would love it. But except for the 1s [and zeros] and the skill and dedication of individual teachers, the curriculum is not as good as it looks. Am I right?*

The Zero Group

In Eastland, as was the case in Westland, there is a pre-algebra section in the sixth and seventh grades.

> *Zero is good. The best [students] gripe about it [the math] and enjoy it. Kids who drop to level one in the seventh are bored stiff. About three-quarters of our misplaced [over] kids are girls. There just about can't be any problems in zero, really, because when the child has the IQ, she can learn just about anything.*

One teacher said it was, "Such a piece of [pedagogical] cake," that they [the zero sections] ought to be assigned to the three shortest periods in the day (see the earlier discussion on scheduling). The level 2s currently have that assignment. A central district administrator feels that zero groups have been successful to the extent that they should be broadened to include more children. He also felt that the eighth-grade teachers may be too prideful of the achievements of the zeros and not sufficiently appreciative of what the seventh-grade zeros had achieved before entering their classes.

Some of the halo was dimmed by a teacher who has been with the zero concept from its start.

> *I have forty in my zero group, [with] four fixing to leave at quarter. The upgrading of math occurred four years ago. (Zero group pre-algebra introduced.) Good pure math. A lot more than could benefit all the zero students. What is lacking in the textbook is applied mathematics. (Textbook, Dolciani's Modern School Mathematics.) Even the average text goes into properties. A kid just does not have to know "commutative" and "distributive" to function in the world.*

And another swipe was taken by a teacher who is recognized as a "super" zero teacher by two colleagues.

> *There is abundant evidence to show that we are encouraging superficial learning in some of our zeros. Sure, they do well on the tests. Our materials on hand encourage this. The algebra book, for instance, is pure abstraction. The really good memorizer can go right through and not really have it at all.*

I have saved the unkindest cut of all for last. It won't topple the head of the zeros, the pride of the mathematical royalty. But there is at least one Whig in the palace. I spoke with a "hard line" teacher who had taught algebra several years in high school who said:

> *Either you teach algebra or you don't. There is either a sequence in instruction or there isn't. Those teachers who pick and choose in the texts for pre-algebra are kidding themselves--worse, the kids. What they pick and choose is what the kids can learn to do without understanding algebra. The worksheets on line equations are a case in point. By the teachers' count, half the kids had no conceptual understanding of the work involved. Understanding the process of symbol manipulation is crucial--and you don't need to engage in formal proofs to get understanding. You [the student] ought to be able to look at an expression and tell if it would be an indicated sum or an indicated product. Most River Acres students can't.*
>
> *The problem most common to us teachers is that we can't keep real algebra exciting for the students. When the students ask, "How am I going to use this stuff?" our usual answer is foggy. The only answer is in higher mathematics. There is no practical value other than that.*

Now that's a tough quote to follow. In anticipation of the Central High mathematics picture, I can assure you of its compatibility with the view held by faculty who teach "real" algebra (the algebra curriculum taught in one year--versus that taught in courses spread over two years).

Open Space

The resources needed to teach the mathematics are seen as ample by the faculty. In fact, there is a curious reluctance to use resources (other than pedagogical wit) on the part of most. "I have all I need. After all, we have an excellent faculty. Too much dependency on AV can depersonalize the relationship we have with pupils."

One teacher called for at least one projector to be assigned to each subject area. And another bemoaned the absence of a chalkboard. It affects teacher demonstration, and pupil boardwork (a favorite of many of the math teachers). Several teachers said that the chalkboard work by students was vital for level three students in particular, so that teacher feedback could be immediate. "You can be sure a child is concentrating at the board. You know he is doing his very best there and [that a teacher's] corrections mean something to him."

Concentration is a "heavy" word in open-space mathematics teaching, as the following excerpt from a teacher interview confirms.

> *It's hard for me to concentrate in open space. I don't care what anyone says it is hard for me to concentrate and have you ever tried to concentrate when you can't? My students don't like open space and neither do I. I dread going to main building next year. I can pick out those kids who come from open space elementary schools. Hyperactive, don't want to sit still. ["The open space concept provides teachers with opportunities to team teach, doesn't it?" I asked.] Teaming in open space? Ha! What kids see is teachers who can't get along. I've got enough [instructional] troubles without teachers arguing in front of kids. Some of our very best teachers do not like it.*

Others say they are "treading water" waiting for the new junior high to open. The noise is recognized by nearly all teachers as being high. (I had to suppress a smile a dozen times a day when I passed one teacher who desperately tried to quiet her group with a long "sssssshhhhhhh"! One kid, at least, calls her "Old Leaky Valve.")

In point of fact I watched several teachers working with children who were seated closer to two other teachers than they were to their own pupils. The seating distance is important only in that their pupils were being "talked to" more "closely" by those teachers. Similarly, the students responding were sometimes from classes other than their own! The style of one teacher was to huddle his group up very close to the front of his area. Most just shouted the word over their area.

> *I think you can see that no one here was trained for open-space teaching or for teaming. We are not open. But it is okay, really. My only dislike is the time schedule. That's what puts the lid on the idea. Open space makes the district look progressive but the ideas are the same old ones. And that isn't necessarily bad, you know. We are "old school" in our leadership. Wouldn't you like to come back and see what we are doing a few years from now?*

You bet.

Cross-grade Communication

By now the reader knows this topic is a dead horse in River Acres. There is very little resident knowledge about what other teachers do in other grades, much less other schools. The math picture at Eastland supported that story--with three important exceptions. One administration informant had the larger district perspective that most lacked. He had taught at Central High School and now has first-hand knowledge of the elementary schools. His comments, while not focused on Eastland, are noteworthy.

> *We follow the state textbook program. The Dolciani series is about as good as there is if the kid can survive it. A lot don't. We have a good math program. We give a little computer experience, but not much. There are no mathematics issues in the high school to speak of. The issues are at the junior high and elementary levels. When we went to the new math in 1964 or so, we were basically opposed to it. Some of the elementary teachers went hog wild; e.g., one third grade teacher would teach a modern math concept all year and never let go--(merely an illustration). We saw a skill decrement in the early 1970s, so we have hit our elementary teachers with the importance of drill and memorization requirements for the past few years. A few years ago, the super section in our eighth grade did better on a computational test than did our high school trigonometry sections. That did it! The young teachers have been reared and teacher educated in modern mathematics, so it is hard to get them to emphasize drill and skill development.*

A fortuitous spin-off of a personnel transfer can be a personal integration of the mathematics curriculum across the junior and senior high grades. "I have a much better opinion of junior high school mathematics teaching than I had before I was here. We are getting better new teachers than our old guard. Paired teams are starting to form. We are on the way up."

The transition role of the junior high mathematics faculty and curriculum can be inferred from the following view held by a key district administrator.

> *The movement from elementary school where it's the same math packaged a little differently for all fifth graders and titled the same, "fifth grade mathematics," to high school where it is five different courses in mathematics all with different names, is great. No Man's Land is grades six through eight where the elementary philosophy is continued by folks who don't necessarily believe in it. It's in the ninth grade that the crunch comes. It takes about two years to whip the kids into shape. They darn near will defeat the teacher in the ninth grade. I am talking about good and poor academic kids.*

Five eighth graders were having a bull session in the cafeteria about what is coming in Central next year. I was listening so intently from my table outside the entrance to the locker room that I was nonplussed when another lad asked me, "How much do you want for your socks?" (The table had a sign advertising the sale of P.E. socks.) This is one way to begin an interview. One boy whom I recognized as a level three math student said this about the high school math curriculum. "My brother says teachers do the same thing they do here if you're in lowest level, only the classes are longer--they have six periods and we have seven."

What's The Big Idea?

Whatever mathematics is in the minds of junior high faculty, it is more like the views held by Central High than those held by elementary school teachers in River Acres. If the opportunity arose, seven or eight of the twelve teachers at Eastland would take a position in high school mathematics teaching. I found no one who would take an elementary mathematics position "given his druthers." Only one teacher requested sixth-grade mathematics teaching this fall.

Another teacher saw the big idea as the contribution math could make to a student's sense of personal competence.

> *The textbooks scatter across the field and diversify without the kids coming back to a core with which they feel comfortable. If the kids had mastery over a core of math then they [could] return to [it] so they could re-charge their batteries.*
>
> *(Another teacher suggested the same thing, drawing the parallel with our need to consume a quick, light, frothy novel on occasion because we want to read but not be taxed.)*
>
> *A child cannot do anything creative until the child has a competent feeling of mastery over something. A child goes to high school pretty scared about his competence. He feels he has had a smattering of everything and nothing really learned for sure. What we should be trying to achieve is a useful, productive, happy person who knows what he is trying to do.*

Before continuing with the Eastland teachers' and students' ideas of what math is, I think it important to share a faculty member's answer that came at the question obliquely when she said, "I don't know exactly what it is but the longer I teach it the less flexible I become."

A new teacher to the faculty, but one with several years experience, saw mathematics as training for "deducing the logic in words, in numbers, every day living." She feels the key to mathematics instruction is not in the direct solution of problems but in the student's approach to the problems. For many she feels it begins, and ends, with the introduction (to math).

> *Students are lacking in ability to read directions--all levels. Reading will panic most of our kids in math, even some of the zeros. If two sentences are given [written] to direct students in a mathematics problem, not more than two of thirty can go directly to the work. I don't have time to teach statement problems. We spend too much time on theory and not enough on statement problems in this curriculum. So we are losing a chance to develop a child's reasoning ability. Statement problems are the key.*

The two redundant themes in many Eastland teachers' discussions of what they thought mathematics was (and what they were trying to do in mathematics instruction) were improving reasoning ability and preparing for more mathematics. Recall the devastating comments of the "hard line" algebra teacher on what zero math was? Her conclusion was, "The only answer is in higher mathematics. There is no practical value other than that."

Notwithstanding that perspective, I find the Eastland students' views of what mathematics is to be instructive. They are drawn from three instructional levels.

> *Level 1* *Putting numbers together in different ways. Finding short cuts, learning how to use numbers.*
>
> *Level 2* *Nothing is hard about math. I get a B. I don't do good on the big test. Math is doing good work on the tests, big and little.*
>
> *Level 3* *I'm in level three. That means they won't teach us algebra. They will only teach us what we have already had. Math is learning over and over what you already know and keep forgetting.*

Note the responses were to the same question, "What is mathematics?" I repeated the question with other students and found other answers, to be sure. But the level one and three student responses were uniformly of the sort presented above, while the level two student responses were varied.

Help Wanted and Advice

The call for help was subdued in this faculty. One pointed to the strategy of a neighboring district to remedy reading skills.

> *A really progressive district like Arthur or Gordon [neighboring school districts] has teams at junior high school working on math, language arts, science, social studies, so the child gets the comprehensive help he needs. Instead of everyone complaining about how reading skills "do the learner in," they do something about it in math, in science. It should be tried at the sixth grade at the very least. We couldn't lose a thing. (Gordon school district has single grade [sixth] schools--an artifact of desegregation.)*

I asked a math teacher of many years in River Acres where the greatest help was needed. "By average kids." It strikes him as odd that the advanced classes in mathematics are the ones with the smallest numbers and hence are more geared for individualization. These are presumably the kids with the fewer problems in learning mathematics.

The last plea came from students to their math teachers. Two in a group of level three students spoke up when I asked what "changes they [could] recommend to make mathematics learning better for them?"

> *At least give us something hard sometime and let those who know it or can figure it out show that they can. ["Could a teacher help with the hard stuff?" I asked.] Yes, no they can't; you either get it or you don't. When they explain it you either know it already or you can't get it, so it doesn't make that much difference. Give us more time and you teachers might be surprised.*

The Great Mystery

I had several long conversations with one teacher. I shared my Great Mystery with him. He said people rarely remember anything they have no feeling about.

> *What does 75 + 83 do to a student? Nothing. It doesn't challenge him. It doesn't mean anything. The books in print in math are there for the sake of a math major or provide meaningless practice to kids who don't know anything to practice.*

Since I am organizing the telling of this story I have saved my pet for the end. This will be my last reference to the "Great Mystery." (It was not mentioned by social studies teachers nor by Central High teachers who will conclude my story.)

> *I have come to call this the "Eight-Year Plague" or "The 24-Hour Forgetting Disease." As best I can determine, it starts in the first grade and gets progressively worse over the eight years. It is endemic in the 3s, widespread in the 2s. Sometimes I think that's what a 1 is, someone without it. Okay, here's an example: I can teach a group how to use base two. We talk about it, do examples. They do it by themselves. Most of them have got it. They talk about it correctly, do the problems. Redo the problems, what else is there to do? The period ends. Oh, by doing it I mean adding and subtracting in base two. Change from base two to ten and back again. I am absolutely sure that about 50% have got it, and I think it is more like 60-70%. Two days later it is 10%. Now what in hell is going on? I talked about it with my educational psychology professor at the university and he says a lot of things about studies and retention/forgetting curves and meaning-imbedded instruction. Good for him. The problem doesn't change no matter what we do. We do everything the experts say. You're an expert from the university, do you have something I can use?*

I was my usual, helpful, professorial self and thanked him for the interview.

Eastland Junior High School Social Studies

The brief glimpse of the social studies curriculum at Eastland reflects the wish of its chairman. Since I did not formally observe instruction or interview faculty other than the chairman (at his request), I have not included students' acerbic views of social studies instruction and learning (which came through in discussions with them about mathematics and science teaching and learning).

The subject in the junior high that is regularly cheated in time and materials is the social studies, and it may be getting worse. The social studies is particularly vulnerable to broad forces which impact on the curriculum:

> *Students have gotten worse over eight years. The things kids need most in grown-up life they don't get. Reading and writing is [being] de-emphasized for taking time to explore, to browse through magazines. Students learn at any rate, and whatever he wants to. We have gotten away from getting down to the "Dick and Jane of things." The achievement tests don't show this, I've checked it, but I think 60% of our kids are two years behind in the junior highs. They are not able to read, in the social studies. Maybe our reading tests don't measure this.*

The social studies curriculum at Eastland is a textbook curriculum because "parents want and the district philosophy supports it."

> *The namby pamby stuff which results in loose, weak students. Seventh and eighth grades are in the ball park. [The solution is] basic geography, map reading, charts and graphs curriculum for the sixth grade.*

The textbooks in use reflect a sprinkling of the social sciences and the faculty is moving slowly toward "having students dig out the facts instead of merely giving them to the students." There is no movement toward inquiry training, or the Taba curriculum which is seen as "a flop in both junior high schools."

The counselor provided an interesting addendum to the social studies chairperson's views when she said that, "Every social studies learning problem is at base a reading problem--not a content understanding problem." The bottom level social studies instruction does often take the form of a teacher first reading to the students, followed by a group discussion.

You can't win them all and this fragmentary break in the study is an instance of clear proof. When I found distinct reluctance on the part of the chairman to my interviewing his faculty and students, I backed off with the intention of returning later in the study when the "climate changed." I never returned.

There are times to observe and to not observe. It is like learning never to buy a pair of shoes in the morning. Well, I bought out of social studies at Eastland one morning in October. A rather weak bridge to transport us to the high school? The distance is short: let's go anyway.

CENTRAL HIGH SCHOOL

> *The end of the trail. Start with social studies. Kids are well dressed. Principal looks young and tough. No reefer smell anywhere on the grounds. Johns are clean! Corporal punishment policy in effect . . . crack, crack.*

More first-impression jottings in my notebook. The principal did not turn out to be as young as I had thought, but the rest held up. The high school building is actually two separate buildings split by an auditorium. One wing houses the ninth and tenth grades pretty much, and the other the eleventh and twelfth. The three faculties studied in this report found this arrangement not to their liking. It tends to create an "upper-class and peons" feeling between the two subsections of each group.

I did very little in-class observing in the high school--only six classes, to be exact. It was pretty much a matter of time and personal choice at that juncture. The absence of open-space architecture made informal observations impossible. So I traded off five days of watching students and teachers for five days of further interviewing, with observing on an invitational basis only.

In 1971-72 Central had about 1,500 students. In 1976-77 it had over 3,300. Before that the school served a twin farm community roughly where Eastland and Westland Junior High Schools are now. The consolidation of 1959 was the first major change. Things really started to change in 1965 with the court order to integrate, and the beginning of major federal subsidies, and the out-migration of families from Houston. (See the introduction of this study for further demographic description.) For the past decade the retention of students has increased annually (for all races). This will be reported in detail.

The faculty is predominantly, almost exclusively, Texan. The administration and faculty for the most part claim they are "as well off as anyone could be in science, math and social studies, given our tremendous growth." The three faculties, teachers and administrators alike, share a common belief that their college training in the liberal arts is what is crucial to knowing how to teach the subject. The knowledge they revere and talk about is that subject knowledge one teaches with. There is little discussion about the knowledge the teacher may need to teach to pupils. "If you really know your geography (biology, trigonometry) you won't have any trouble teaching here--except for the kids who don't want to learn."

The change in school enrollment has brought obvious and subtle changes in the high school. There are proportionately fewer Mexican-American students (40% in 1965, 30% in 1971, 20% in 1977); and Blacks dropped from 20% to 15% to 10%. There are no more study halls, and a parallel policy which permits seniors to get "off-campus" the last period of the day is in effect. With each weekly increase in enrollment there is a corresponding increase in the felt need to manage the school. The high school staff and administration "give it our best shot." They do not have time or the personnel to step back and try to see what results seem to be associated with change. "We have no formal student data control system, or program evaluation effort," as one administrator put it. "In fact the data base we do have was created by the federal government's requirements." Federal data requirements result in the average, white student being the least-studied child in River Acres (in America?).

> *People count National Merit Scholars, Blacks, special education students, Latins, drop-outs, work-study students, what have you. The regular Anglo student is the "least-counted."*

The soaring numbers have brought about isolated but remarkable "last ditch" efforts to preserve contact with pupils in Central: e.g., a counselor uses next-quarter computer printouts of student schedules to exchange notes with her charges. "About 50% of them send me their messages. They know I read them and will respond." I checked through a stack of printouts and quickly found: "I may flunk this," and "I want to go to college now," and "I'll see you soon."

Meanwhile, Central High School patrons are seemingly confident of its quality program or are apathetic. A district official said:

> *Back in the early sixties everyone was examining the high school here. (James Conant was read by River Acres School Board members.) Now the emphasis here is on little kids. People seem to take the high school for granted.*

My informal survey of parents corroborates his view. There were notable exceptions, from a parent's distress with an aspect of her daughter's education to a parent of a small numerical minority that could be troublesome for the administration. One parent said she felt her daughter should not have been put in Algebra I (she failed it). The parent did not complain to the teacher or the administration but said, "It seems funny that every third student should fail a course if it was taught right." (I found that in one recent semester about 50% of the students failed the course!)

Another parent whose college-attending son had done very well in algebra at the high school said with considerable vehemence that the district wasn't being honest with them. He sneered at an item in the district's Handbook for Parents:

> *No child . . . should be required to work at a level for which he had not adequately acquired the skills necessary for successful achievement.*

"And one-third flunk!" (he exclaimed).

Another parent cornered me at an elementary school presentation one evening. He had children in Central and that school. He wanted to have his say on instructional levels. We had both witnessed a Christmas presentation in which hundreds of elementary-age students had participated.

> *In elementary school kids know their parents care. The flashing bulbs at the 137 Santa's elves; mothers driving them in early for teacher help; "What did you do at school today?" at supper.*
>
> *But what is there in high school if you aren't a cheerleader or athlete? What is there to take pictures of, or ask about, if you're [your offspring is] a level two or three student [in Central]?*

These were the odd cases. The high school has its problems, its detractors, its failures. But a vast majority of its participants and its patrons either don't think about it or think well of it. Next, a few observations about its teachers, followed by views of grouping, testing and grading, and some indicators of success, failure and student retention.

The Teachers

Until very recently Central teachers were not bothered by departmental or district evaluation of their work. They still aren't--but exceptions have made their mark. A few years ago a department head put several teachers who had been there for eight or nine years on probation. Two administration informants and one teacher said, "It 'worked' in that it got those teachers going" (or gone).

Teachers complain about the demeaning jobs of early morning hall duty or "potty patrol" and the sign-in (before 8:10 a.m.) and sign-out (after 3:45 p.m.) sheets. I sensed that one teacher had been waiting for someone to talk to for some time. He begins with behavioral objectives and ranges widely over his realities of high school teaching.

> *When does a teacher have time to write behavioral objectives? When does a teacher have time to really think about curriculum problems? A teacher doesn't have time to teach. I have never seen so many demeaning jobs, positions in my whole life. We spend no time together sharing ideas. I read so seldom in my field that it is terrible. Grading papers takes over 50% of my so-called free time. Student assistants could help file, alphabetize, score objective tests, create scoring distributions. How would you like to be fifty years old, with two professional degrees and have potty-patrol? Or sit out here and watch the door for thirty minutes every morning? Why should I come here ten minutes of eight to sit at a door? My wife has taught in several places. It is no different. My comments describe but are no criticism of this administration particularly. That's what teachers are supposed to do with their time.*

No one mentioned evaluation of their teaching or its consequences as troublesome. They do see themselves as models. "It's not so much what I say as what students see I am," a middle-aged male teacher offered. He and others are supported by River Acres policy in the Handbook, which emphasizes the teacher-as-model:

> *. . . instill in students respect for constituted authority; you should always greet your class at the door of your classroom . . . the habit is "catching"--they will observe and seldom be late themselves.*

The twin emphases on modeling good behavior and school as preparation-for-life come through in the Handbook's discussion of "Assembly Conduct":

> *. . . Take an opportunity to teach our students when to applaud, when not to applaud, when to be reverent, when to laugh. The necessary courtesies learned by our students now will remain with them as adults.*

If the teacher needs help in the form of supervision from the district, it will probably be unmet. The help must come from within oneself or from departmental colleagues. The latter will be discussed within the context of the science, mathematics and social studies curricula. Many of the teachers' problems in secondary are seen as the result of Texas certification requirements, not the particular subject curriculum. One district official said:

> *It [TEA certification] is the millstone around our necks. The requirements have little to do with the instructional problems confronting our staff. But you have to be certified, so you attend to those courses and let the world of Central roll on by. . . .*
>
> *[The district's policy on] supervision is "nowhere." The [school] board feels we have too many administrators. They fail to make the distinction between administration and teacher in-service help. This means curriculum construction and implementation is pretty much editing in the district office. No help goes to the classroom teacher directly.*

A survey was taken of the attitudes of teachers toward an in-service program provided by the district four months before I came to do this study. The questionnaire forms had not been scored when I left. "The data are getting cold. This is particularly troublesome in a district with the change going on as it is here."

Before turning to instructional levels I offer a personal conclusion drawn from my conversations with over 150 teachers and administrators in River Acres. Compared to the primary teacher, the secondary teacher is more sure about what she is doing, but is less satisfied with the results. Conversely, the primary teacher is less certain about what she is doing and how to achieve her goals. She is apt to be pleased with her results. In the handful of instances where I could listen to primary and secondary teachers talking with one another about school, this presumed difference was overlooked or not recognized.

Instructional Levels

I constructed an estimate of the levels for the senior class by counting the number of sections of the government course which all take. There is no top-level section; six sections of level two; eleven of level three; and four of level four. The senior class counselor felt that would exemplify the distribution for English and social studies as well.

Although figures are not available within the district, my distinct impression is that there is increasingly less movement between instructional levels as the River Acres students go up the grades. One elementary school counselor estimated that "30 to 40% of the children are re-grouped for something or another by the time they have reached the fifth grade." Conversely, a high school counselor estimated, "Not many [move from one level to another]: about a 5% maximum."

Any student requesting a move from level two to three or the reverse is honored. There can be no movement from or to levels one or four without the approval of the counselor. Behind every instructional level disagreement lurks either a basic reading or an arithmetic disability. The discussion may be cast in the language of science, or social studies, but it is usually the matter of what to do with the poor reader. From kindergarten through the twelfth grade, teachers agree: the student who is weak in reading is doomed to fail in River Acres. Two high school counselors said that, "There isn't much we can help anyone who cannot read by high school." The slow student who is trying may also be in trouble. By the teacher's own admission,

> *That kind of student I just don't know how to work with. Nor do I have the time. The quarter marches on, you know. So we give them more of the same, perhaps slower, perhaps louder; then when that doesn't work we just threaten them . . . and finally ignore them. Average teaching approaches just do not work with them.*

An administrator said it, but it was echoed by several high school teachers as a shared view: "The key to the whole thing is reading; and we cannot distinguish a student's inability from his lack of will to learn to read. The facts are students know they do not have to read to pass any course in our basic curriculum."

Tests and Grading

The formal standardized testing program in Central is comprehensive. For example, in the tenth grade the following areas are measured: science, math (computation and concepts), reading, vocabulary, spelling and language expression. How these are used in grouping students is not clear. They are used by counselors but very rarely by teachers. Since teacher judgment is a key factor in group placement, it would appear that the test scores are of little consequence for this purpose. The district also has initiated a minimum competence check in reading comprehension and mathematics for its seniors in response to Texas regulations. The tests take about three periods to administer. When I asked students what the tests were for and if it affected their graduation, none seemed to know: "Just something you gotta do." A few articulate students feel that the goals, while admirable, encourage an implementation policy which must be held questionable. (Several faculty agreed.)

The grading policy is most explicit, with a uniform point range associated with each letter grade.

99-100	A+	88-90	B	77-79	C-	69 & below	F
96-98	A	85-87	B-	75-76	D+		
93-95	A-	83-84	C+	72-74	D		
91-92	B+	80-82	C	70-71	D-		

A former high school teacher, now an administrator asks, "But who can say what a 73 is?"

Success and Failure

The college-bound student is the pride of the district. A counselor went to twenty-one government classes (all seniors) in the Fall of 1976. Among other information she obtained a glimpse of the college plans of the seniors. By level, she estimates that 85 to 90% of the one and two level students will go, 50% of the three level, and 10% of the four level. She felt these estimates represent lower limits and would not be surprised if more did go to college. She did not comment on the realistic appropriateness of the students' intents.

A social studies teacher did. (He had just finished a frustrating hour with a group of two level students who "did not care how historians validated their information.")

> *I say that the senior class has 10% college material, maximum! Sure 75% of them will go to college. That doesn't cut any mustard with me. We had a study a few years back [1972] that showed a lot of students who insisted on college prep programs never went to college.*

Over fifty juniors scored 1,000 or more on the SAT this year and the district boasts five National Merit Scholars (PSAT 99th centile) and seven Commended Scholars (95th centile). The senior class counselor shared a most interesting story of "early identification of talent" with me. River Acres tested the present senior group as tenth graders and found 23 (of 820) with semi-finalist scores (99th centile). That group was placed into a major works English class as a group. On the basis of those scores, "We next considered an additional 402 students in that class as college-bound material."

In the eleventh grade the 402 students were retested (less those who had moved) and not one of that group joined the "top 23." Furthermore, the top 23 all achieved semi-finalist status again. Lastly, the top five stayed the top five! A last comment on test results quality indicators: 46 of the students in the senior class had SAT scores over 1,000.

An observer of the district for many years also saw the college-bound (intent or fact) student as, "very well served. That's our upper 50% at most, I'd say." The estimates ranged widely about the size of the college-bound group. One fly was added to the ointment of success by an ex-high school mathematics teacher.

> *The apparently successful 50% contains Pyrrhic victories. First, we have the student pushed into college that pays the price in personal anxiety, false expectations. Second, we know those who get good grades and think they know math and science because they have mastered the art of getting good grades in River Acres. They are rudely awakened in college.*

One former Central science teacher challenged the "Pyrrhic victory" assertion: "For every kid that is pushed too much, there are two who are not challenged."

One night each fall, all Texas colleges are asked to send a representative to the high school. Each one that does come sets up a room and the students and parents shop the academic smorgasboard for information. They come to find that certain Texas institutions require more than others for admission. Texas A&M, for example, has a four-year English and a three-year math requirement. Others require three and two respectively. The University of Houston is among the lowest in its requirements fortunately, or unfortunately, according to your geographic perspective.

Students are failing in Central High School as they do everywhere. "Let's not deceive anybody by saying we give help to those who need it--because we don't. We give the help to those who cry 'Help!'" a high school social studies administrator argued. A long-time district employee, who works with vocational education math students, commented:

> *Kids are in high school today that would not have been there ten years ago. But the real loser never makes it out to the River Acres Career Center. Even if that kid does make it out here and gets skilled, that's not enough. Auto mechanics can't take kids who are asocial or unskilled with people.*

I had a brief conversation witn the "minister of corporal punishment" in one wing of Central. He had some firm ideas about why kids fail and succeed and what the ninth grade means to many kids. The ninth grade means the driver's license first of all.

> *Without a car these kids are a nobody. The average group is a huge, smoldering problem. No place to excel, bored, frustrated, frightened. Smiling bravely down the hall to the next class. The scared ones pick too low a level. They can go to [levels] two or three on their own. [Need teachers' recommendation to go to either one or four.] Not a big problem, really. Boredom is aversive to most students regardless of level.*

The quarter system eases the pain of failure and allows sufficient curricular (scheduling) flexibility to provide remediation.

> *There is enough time in the schedule for teachers to grade tough and kids to fail but still graduate because of our quarter system. A hidden benefit in moving from semester to quarter system: [one can] flunk and graduate.*

One warm fall afternoon I approached a group of male students who had just fled from the "rent-a-cop" for smoking in the parking lot. They were near two sets of concrete steps which led to a building long since removed for use of another temporary site. I asked what "they" (steps) were. In the conversation that ensued one lad quipped: "That's the graduation steps for the dummies. They lead you right into the world." Ouch!!

Retention

Among my key informants in the high school were the counselors. Ironically, the better they do their job, the more suspect they were held in the eyes of some. "He wants kids to graduate, at any price. Do anything to get them out of here with a diploma in their hands."

I got too interested in the question of retention and student mobility in this sprawling district. As a result I got roped into doing some "real work" one afternoon in Central, poring through the records for the class of 1977. I started with the 750 students who began ninth grade at Central in 1973. By my count there were 588 left (or 78%). That surprised me. It was at variance with a majority of the teachers' beliefs. Most thought it was around 50%.

To these were added an in-migration of 76 in the tenth grade, 66 in the eleventh and another 66 in the twelfth. The picture is completed by departures, dropouts, leapouts, whatever: 140 left as tenth graders, 36 left between the end of the junior year and December 1976. (Three left the week I was in the office.)

While I visited the counselor's office I learned about an effort to help failing students graduate. The junior year is the most probable year a student will drop out (not leave the Houston area due to family relocation) of Central High. Students must be seventeen to drop out and seniors are motivated to "see it through." Just before the summer of the pre-senior year the senior counselor called forty "near-sure drop-outs" to suggest night school, correspondence courses, or contracts to make-up deficiencies which would assure class-of-1977 graduation. The results: twelve went to summer school, eight are presently on contract, and one went in the service and took the GED. That is batting .500, which can earn you the description of being a major league counselor or one who is "overly concerned with kids graduating from high school."

Central High School Science

Parents who were themselves high school students in River Acres would hardly recognize the high school science curriculum of today. In fact, the class of 1965 would find it unrecognizable, according to several of the old timers. As was indicated in the junior high discussion, in grades one through eight science was little more than "dead robins and magnets" fifteen years ago. One high school observer described these changes and more. He cited:

> *A major change over the years. Sixth-grade physical science is what we called general science in junior high twenty years ago. Our major problem is that science gets the kids over their heads in math so the teachers have to teach mathematics, too. They may or may not know how to do it. Another advancement is seventh-grade life science. It is as good or better than our high school biology was ten years ago.*
>
> *The mid-sixties found chemistry looking more and more like physics. Our first-line chemistry course is loaded with mathematics. Some teachers want to change our second year chemistry course to emphasize oceanography, for example. Parents say, "No"; they [students] need solid chemistry to get into and do well in college.*
>
> *This is true also for biology. Some of our teachers want to provide a sampler of "quick looks" into new areas for students in the form of mini-courses. Teachers want also to make second-year biology and chemistry more applied to social problems. Another related problem is trying to convince people that physics is so basic that a kid may need it as much as a second course in biology or chemistry. As a result, physics has never been heavily enrolled here. Another reason, of course, is that it is tough. Physics got "far out" because of a movement in Texas to put mechanics in physical science. Recently we have let up a bit in the physical science and physics courses. Earlier everyone was going to the moon. That's passed.*

It would be fair to say that the "good old days" in science instruction in River Acres never existed. The quality of instruction, the ability of the teachers and the students has been increasing steadily. Not many students went to college a decade ago; and those that did rarely achieved much in science. The present state science curriculum is not without its critics.

> *We require things in Texas that we don't really need (said an administrator). It is crazy to require two years of science when you don't need to. You are talking about a difficult thing [two years of science].*

The state requires that 60% of a science course be laboratory in nature, or approximately three of the five periods each week. The teachers say this cannot be met. Laboratory experiences are hampered by equipment failure, in a few cases by sections with too many students, and by the realities of the time it takes to set labs up and break them down. "Successful experiments occur only when they are set up so students have no choice but to learn rather than just fool around." (Laboratory work necessitates students' being more on their own than does lecture, as a subsequent section will reveal.)

Somewhere between the apocryphal "good old days" and now, a personal touch with the student was lost, say some. One old science teacher bought a plant for each student to trim, prune, water, mix the soil; and even wrote a manual to accompany the work. He spoke nostalgically about the relationships that grew out of some of these student-plant-child relationships. One lad who began by seeing plants as "unmanly objects" ended with a different attitude: "That boy would have planted his pencil if he thought it would grow." He recalled being able to know which students had which plants. Now he can't tell you the students' names. He is nearly alone in his feelings--which in no way affects their poignancy.

During the early and mid-sixties parents were quite involved in the science curriculum, principally through the science fairs. Since the demise of the fairs around 1970, parents want to know only if the science curriculum "is keeping up with the current trends." On a rare and recent occasion a facet of the science curriculum, sexual reproduction, for example, has brought a parent to the district offices for administrative intervention.

Until four or five years ago immigrating Northern students were typically "ahead" of the River Acres students in physical science achievement at the high school level. This no longer appears to be the case. Indeed, the trend may have been reversed.

In the past two years new courses have been added to the science curriculum: marine science, environmental science, a second course in chemistry and physics. Curriculum experimentation in science does not characterize River Acres, but it has occurred. The story of the science shack presented in the elementary section is one example. Not all experiments have such positive results, though. Five years ago the district sent a group of students directly to high school biology from junior high school (bypassing physical science). Only the best students were selected. Two people independently described it as a failure. Apparently the students had problems in chemistry and physics with which the teachers were unable to cope. In addition, there are problems with the present system--but that comes later.

Most science teachers think that their science students who go on to Texas universities do well in their college courses in science. In chemistry, for example, teachers expect their students to skip the first semester course in college chemistry (if they get a B or better at Central in Chemistry II). The teacher, who offers Chemistry II also offers Physics II on an independent study basis on her own time, says that:

> *Freshmen in college come back--even C students--and say, "I am glad I had your course. It made chemistry or physics so easy." They knew everything even before they were were taught it in their college courses.*

(So much for the intent to proficiency those first courses in college.)

Reports are mixed about the relative-quality image of River Acres High School science with that of neighboring districts. Here are two teachers new to the district with quite differing views.

> *I've been in several districts and I don't know of any other one I'd work for. We have models, transparencies, overhead projectors. I'm pleased so far.*

> *Our district is far behind other adjoining districts.*

Similar judgments were found among other faculty, but the basis for the judgments were not clear to me. Changes recommended by teachers later in this section may yield clues.

Several of the teachers have master's degrees in science and the prevailing belief is that the incoming teachers are increasingly stronger in their science content background.

The Curriculum

Although the Texas state regulations neither prescribe nor recommend a sequence for high school science instruction, they do prescribe two years of science. River Acres' sequence is ninth-grade physical science and tenth-grade biology. The only prerequisites in the curriculum are Chemistry I before Chemistry II and Biology I before Biology II.

The state requires laboratories to comprise 60% of the secondary science courses. Chemistry II and Biology II are conducted seven periods per week with two of them offered one evening. The state requirements have been "under revision" propaedeutic to developing a state science "framework of mini-courses" for several years. One science specialist advised me "not to hold my breath waiting for its birth." Moreover, once born, "It will be administratively next to impossible to implement." (He sits on the state science committee.)

Instructional Materials

The textbooks are central to each course with the exception of the odd course where "a good one cannot be found." In marine biology the teacher uses stacks of magazines (Texas Wildlife, National Geographic) as her content source. My biases showed when I complimented her on doing a clever instructional job with them. She replied, "I wish I had a textbook. I would love to have a textbook. Do you know of a good one?"

One teacher in physical science who taught level 2s and 3s checked on the reading level of the text.

> *Some passages are at the seventh grade, which is a blessing; and some are at the tenth, eleventh and twelfth grades, which is damn folly. Most of them are up there. The problem is, it is about average on the list.*

The list to which she refers is the Texas Educational Agency's state textbook adoption list of five texts, from which districts can select one.

Two other physical science teachers declared they could use more than one text in their instruction (even if it were an "out-of-adoption text"). In general, they find that they need more things for the students to do than they currently have in the one textbook.

The sound films which the district owns and those available from Region IV are the subject of much teacher ridicule. This from the chemistry/physics teachers: "We cannot use them. They are a big disappointment--so out of date."

The "good ones" present another problem. They are such "best sellers" that everyone uses them.

> *Kids have seen that film I showed four times [about the structure of the atom]. I get irritated. They should never have seen that film. Half of them still can't understand it. [A similar story was told about films in biological science.]*

The use of film strips in high school science instruction presents quite a different picture in River Acres. A biology teacher spoke for several others saying: "We use film strips a lot. Particularly with level four students. The kind that don't 'talk' are best." I saw a teacher using one set of filmstrips that had audio cassettes as part of the system --but she chose not to use them. I asked her why. "When we use the cassettes students often react as they do with 16mm sound films: Free Day!" As I watched and listened to her use of the non-sound filmstrips, I thought she made her point. The group was obviously orderly, attending to her presentation and the film, and asked content-specific questions about it afterward.

Another teacher, this one in physical science and in her first year in the district, after teaching seven years elsewhere, also saw the medium sending the students a message. "A filmstrip means instruction. A film means recreation. An overhead projector means no reading and a TV means, 'I must be at home'."

There is a district-wide problem associated with the maintenance (always repair--not preventative) of instructional hardware. Equipment such as laboratory microscopes, electronic devices, audio and visual recording devices, projectors, present a persistent problem. Estimates run as high as one quarter of the equipment being unusable.

I did not hear teachers or administrators complain widely about audio-visual services. Indeed, the increasing use of audiovisual materials in lieu of print materials was humorously censured by the superintendent in a staff meeting: "We have teachers returning from AV workshops who would rather laminate a hog than buy a pork manual."

The Students

Student interest in high school science is changing. Everyone agrees on that. But how, for what reasons and to what qualitative ends? I sense the potential for a useful study on such issues in River Acres. I have just scratched the surface. As one senior girl put it, "You're the kind of guy who feeds the juke box on your way out."

Upper-level Central science students describe themselves as being different from what River Acres has had in the past. (Nothing unusual about that. Don't all students think theirs is a unique group? And aren't they right?) The interesting thing is that teachers agree: "They are wilder." "The gap between the top and bottom is widening." "Central's average of today would have been our best eight years ago." "They are smarter and smart-aleckier." "They are more serious, more able . . ." These are fragments from unrelated conversations with teachers and administrators about Central students. Another one: "Kids know about genetic manipulation, problems involving science in society; ecology, germicidal warfare; far more."

I spoke with two members of the class of '76. They were excellent students in Central and are now freshmen at Texas universities. They reacted to several conflicting views of 1977 "New Crop" students positively. "They're all true!" "It depends on which classes, levels, social groups you're thinking about." They said their Central High Biology II, chemistry and physics courses were "super." Biology I was recalled as "a course with low difficulty and obvious content."

The only and winning candidate for a poor (read that "rotten") course was physical science, where the content "was a repeat of elementary school ideas on a lower level." (Its teacher is no longer on the science faculty, they were delighted to point out.) Current level one students in physical science say they are "impatient to get to chemistry and physics without this 'Mickey Mouse'."

Other students saw Biology I as a bunch of "unrelated things that must be covered in a short period." They and their teacher independently describe the course as one in which you "run" from one thing to the next. Another Biology I teacher whom I did not observe teaching speaks:

> *It is like hoof and tails getting them to be interested in biology. But I finally struck gold today by reading from a book about how to raise your IQ: how a biologist and an educator view IQ.*

Students in courses other than biology complain about the rush of a quarter system and the slowness with which their papers (tests) are graded. Teachers defend themselves:

> *But that is because I don't care if John got the answer "5 Newton." Show me how you got the answer "5 Newton." So I grade set-up, procedure. Apt to happen more when the kid is in a higher level science or mathematics class.*

A physics teacher has been changing her course.

> *I have been building up my material from different textbooks for the last four years and I have reached my peak. I am not going to add any more. Classical physics is what I stress. They can see classical physics; these are things they can see, understand, draw a picture of. Modern physics leaves them out on a limb; quantum and relativity can't be seen, felt.*

Students and teachers are in considerable agreement about a slight margin of interest in science held by boys over girls. (I found no evidence for this in the elementary schools and an equivocal situation at the junior high.) Chemistry and physics are the outstanding examples where the course interest, achievement, and long term interest of boys apparently exceeds that of girls. Similarly, in biology:

> *Boys [are interested] a little more than girls in level four [Biology I] and finally by the time they get in a second-year biology it is considerable. For every four or five boys enrolled in Biology II there is one girl.*

The girls can be counted on to get slightly better grades "because they turn in assignments on time," or "do neat lab manuals." It's the boys who "lead" in the laboratory, as I shall report in the next section.

Before turning to the labs, I note the absence of Mexican-American and Black students in the upper-level sections and advanced courses in science. A retired teacher who was subbing in junior high science during my stay put it in an historical perspective:

> *Before 1974 they were all in special education: since then they have been phased into the regular program. They just can't read and the new words do "keep coming" in science. But it isn't only a matter of scientific terms. I once asked all the kids how many had ever been in a cave? Do you know what it smells like? Over 90%*

> *of my poor kids had never been underground at all. Never below ground level: think of it! Meanwhile a lot of my upper [social class] kids have rock collections, have visited mine shafts, have had more first-hand experiences than most of their teachers.*

A current teacher of level four sections in science observes:

> *Mexican-Americans being in level four almost exclusively is not a result of prejudice. It is a self-examining proposition. They select themselves into it. It is their nature. Genetic, if you know what I mean. Not racist.*

I asked a Chicana science teacher about this and she agreed. (There are many who would not.)

Laboratory Work

The things I saw and heard about laboratory work in high school science are presented in three themes: facets of the lab itself and the groups' size, purposes and instruction, and the behavior of students.

Group size truly seems to make a difference in high school science lab work. When there are twenty to twenty-four students in a lab things go much more smoothly than when there are a few more. (Some now have thirty-two students, with facilities for only eighteen.) It is a matter of equipment and space. The laboratories are well-equipped, scads of wall space, and have one microscope for two students. Some of the microscopes are new (electric) and some are old (natural light). This scarcity of resource (new ones) causes a management problem for the teacher. The microscopes caused additional crowding because of the need to be near electrical outlets. Care of equipment, especially for things like terraria in marine biology, is an increasing problem as the group gets larger. "There is no such thing as thirty kids taking care of anything."

Supplies are not a problem, chemical or organic. "We get all the sheep hearts and worms we need." Work on the eye and brain are avoided because it would deny certain children the laboratory experience because of religious convictions, according to one teacher.

The instructional purposes of lab work are an issue. First, there is general disagreement among teachers and students. Students want to "get in there and do it."

> *These kids think they should be able to just go into a lab and cut up a worm. Just cut him up. The steps and the reasons [for dissection] are not important. Just go to it.*

I talked with kids as they came out of an earthworm dissection laboratory. They looked and said they felt "freer" in laboratory than they do in lecture. This feeling of freedom in a tight lab space (there were thirty-one in there) creates problems for the instructor. She told me she spends "too much time on such problems." Most teachers for one reason or another fall short of the required number of lab hours. One said she tries to get 20%. She does not think the purpose of laboratory work has really been thought through with sufficient care, and adds:

> *The great number of hours required means dissecting earthworms. What else is there to do? Many lab activities are personally offensive to many and of no interest to the majority.*

Other teachers do laboratory work in their classrooms. "You don't have to go to a lab to jump up and down and measure the heartbeat." Another has the idea that field trips could be applied experiences to count as laboratory time, but the logistics defeat implementing her idea:

> *I have eighty students. I won't take more than twenty at a time. That means four trips to the beach. So I don't do it. Perhaps I could take the whole group to a shrimp hatchery. Maybe I could take them to the beach during the winter so they won't go into the water. Also, it has to be on Saturdays.*

The third cluster of observations on laboratories are about the students themselves. After watching the girls read the laboratory procedures to their boy lab partners who then pin down the frog, I wondered if it was always thus.

> *Girls have "scoped" out their roles for sure. They are the housewife; Daddy is the doer. The boys do the step-by-step lab procedures based on what the girls read to them. And don't ever let on you know more than him.*

A second female biology teacher agrees. "Boys are more interested and do more in laboratory work than do girls. In our drug work [applied stimulants and depressants to organisms] the boys lead the way."

There are wide-ranging differences in the effective use of laboratory time with level three and four students. Some teachers cite, "Fewer, not more, behavior problems in my labs with 4s."

I saw one level four lab of that teacher and there were no problems of note. But when it is bad . . .

> *When you go to a lab with a 4 [group] you have got a problem. It is better to do teacher demonstration. It is often better because you get the right results and they almost never do. They are so busy breaking beakers they never get anything completed anyway. So at the very least the teacher can show them how it does work if you do it right. Their attention span is so short they will be wandering off doing something else if you don't watch them closely. They'll really destroy your lab if you're not careful. Over 60% [of] level four are boys. Black kids get assigned to level four mostly because of a reading problem; next because of a math problem; next because of a discipline problem; and last because of a science problem.*

Instructional Levels

Science instruction by levels is seen as a good thing and one which is working to the satisfaction of most students and teachers. The counselor speaks for most:

> *I am not [kidding] you. We have teachers who are fair, have high standards, are conscientious, and who are competent. I have my problems with them as a counselor but that much I grant them. I would feel bad about the levels if the teachers were not excellent. The levels are here to stay and I personally don't mind [having] them--nor do I question them at this point in time.*

The reader should bear in mind when or if the mathematics and social studies sections are read that the counselor is talking about those teachers, too. Level one is referred to as "major works," and has about 5% of the students. Level two is "accelerated" and has about 12%, level three is "average" and has about 70% and level four is "basic" (below average) and has about 12%. The advanced science courses Biology II and Chemistry II and physics are level one only.

The senior-class counselor has worked with the graduating class of 1977 since their entry to Central High School in 1973. She finds no "big failure problems" in science (as will be the case in mathematics).

> *Prestige is involved in being in Major Works. When you get into FOM in math it means two years--or the two-year "algebra" course. In science it is the same course and the levels mean slower pace but same content.*

There is a debate about whether a level three in chemistry should exist. It is offered to "give college-bound students a chem course on their transcript" and all such students are recommended to take it. The teachers of such sections question whether it is "really chemistry" when the content is minimized, the mathematics is minimal and the coverage is foreshortened. A shared teacher view I found was, "the problem with chemistry is mathematics."

Students and faculty alike give high praise to the level one courses. Not all teachers want to teach level one, a departure from the junior-high story. "I'm glad I don't have a level one. I am learning with my students and am not trained in [this aspect of] science." (A majority of the faculty probably wish they have more level one or two courses.) A Biology II teacher of level one students surprised me when she said that the good students were not all that interested in biology.

> *They really put out because they want the grades. But they don't take that special care. They are busy socially. School is only one thing competing for their time. Some kids come to lab at night by taking two hours away from their jobs. Leave work at six, stay two hours, and go back to work. School for them has become something to work into their schedule. It is not their life work.*

Biology II was offered for the first time in the school year of 1975-76. Now Central has several sections of it. Marine science and environmental biology courses have also been added recently. As we will discover in math, the science courses are generally regarded to be "better" by the faculty when they get "harder." The principal reason offered for this belief is that the better students and teachers are in these courses and the motivation is higher.

One place where the motivation is not high is level four. Teachers of level four and their charges told me in no uncertain terms that biology was not of great interest to the students. "The level three student will often tolerate details more so we teach more details to them." (The same text and curriculum are presented to the level three and four sections in science.) I did interview one biology teacher who claimed that she was doing a good job with level four students. I did not follow that lead and probably should have. One level four class I did see, and whose instructor I did talk with, "told it like I saw it."

> *Most are there because of discipline problems. And, most are there because of reading problems. Few are there because of conceptual difficulties in science. I have students who can answer the questions about the periodic chart. They know it. But I can't ask every one of them individually. I think there ought to be a reading class in every junior and senior high that you don't have to be in special education to get in. I have students from India, Mexico, Viet Nam, who need help in reading. They can't get it from me. Without exaggeration they could be in level one instead of the level four that they are in if they could get help with their language problems.*

She said she expected no help to come from the district on the problems she is experiencing because "they have their own problems just keeping pace."

Regardless of the level, the shared goal of the students in science is "to get a good grade." Students in levels two, three or four (which have 95% of the students) do not say they are in physical science or biology to learn something substantive about the field. The reasons for getting good grades were several--but grades are the thing. Level one students did talk about science, about their interest in it--and about getting good grades. The competition for getting good grades appears to be considerable in the upper levels.

Compared to the junior high schools there is little discussion about misassignment to levels in science. I found references to misassignment, but always in the context of a more pressing problem.

> *Misassignment is detrimental in my teaching. With the size of classes mixing the levels would be disastrous. Teachers are human: we respond to students who listen to us and ignore the lazy and disruptive ones, even if that's unfair to them.*

The overriding characteristic of grouping students for science instruction in the ninth and tenth grades is its necessity.

> *I can't imagine having all levels of kids together. You couldn't do anything except bore the top two groups and go over the heads of the lower two groups while you taught for the mean. (Level three teacher)*

What's The Big Idea?

From time to time in this story I judge it useful to let the reader know what I think. This is one of those times. After watching a very few hours, listening for three days, and reading for several weeks, I was surprised to discover what the faculty thought the big ideas of science were and what they were about as science teachers.

I saw them teach and heard them talking with students about science as principal ideas with the facts that support those big ideas: concepts such as momentum, energy transformation, cellular differentiation, taxonomies, laws of conservation, probability and genetic coding.

But when I directly asked what the big ideas were, they used unexpected (for me) words. I expected them to stress science content heavily. Here is a sample of several teachers' and administrators' answers:

> *That's easy; understanding of self and the realtionsip of how things relate to him.*
>
> *They have to appreciate technology, not just understand it and see how to grab it and build on it.*
>
> *To do well in college science. It's as simple as that.*
>
> *To advance the culture and heritage through the use of expertise.*
>
> *To understand the issues related to the location of a nuclear energy plant, a land fill operation and a pollution-ecology debate.*

> *My big ideas are community disease, public health and recycling water courses. But what we do is probe sheep hearts and dissect earthworms.*
>
> *The principal goal is to leave science with a favorable impression.*
>
> *To prepare them for life ahead.*
>
> *Drum into their heads that the scientific method can be applied to every situation in life.*
>
> *The top of the pyramid. The place where all their math and science come together. (physics)*

Are these harmonious? Does it make a difference what the teacher thinks the big idea is anyway? Would the faculty find a discussion of their list of big ideas instructive?

Two of my interviewees said a lot when one paused and said he couldn't answer the question; and the second said, "I haven't had time to think about that in a long, long time."

The Science Courses

The parts to this section are ordered to parallel the course sequence at Central. We begin with physical science (ninth grade), move to biology (tenth grade) and conclude with chemistry and physics (eleventh and twelfth). A majority of the science teaching faculty think biology should be offered in the ninth grade and physical science in the tenth. The reasons most commonly offered are ninth-grade algebra would be helpful in physical science; and the content of biology is "where the kids are" as freshmen.

Physical Science. The story in physical science is that it is a "bad news course" in the (unpublished) newspaper of students. Physical science is required of all ninth graders. The top-flight kids see it as short on challenge and the bottom-flight kids see it as useless or boring. The middle-flight prefer biology because it is easier or more interesting.

A chemistry teacher said that the physical science teachers are "the bad guys of our department." She says that part of the problem is the preparation of the students in junior high school.

> *What you find out first quarter is that "saturation," "solvency," "solution," "precipitation" really mean nothing to these kids. They have the names but not the concepts. They can argue about space travel but don't know what a planet is.*

In the words of the chemistry/physics teacher, the same phenomenon occurs later when:

> *They know their radicals and oxidation numbers. It can make a difference but it usually does not, because they don't understand the things they have learned.*

The summary description provided by four teachers of physical science was, "The lower the kid [instructional level], the lower the physical science interest." The lower level (average and below) students like biology much better than physical science.

> *They could care less about the three theories about how the earth came into being. That was past, the earth is already here; big deal! They don't see the atom. They do see birds. [No moral or ethical issue hinted at by kids at all.]*

Another teacher of lower-level Biology I corroborates the picture provided by the physical science teachers:

> *The kids are more interested in biological science not because of the "humanistic interest hypothesis"--but because it is easier. More kids can relate quickly to biological sciences. Only a few can to the physical science.*

I talked with two girls who were in chemistry level two because their parents said they "had to [be there]." They recalled their days in physical science and biology. "We spent about two weeks on that sheep heart and we spent about two weeks on electricity." The second girl agreed but also stressed how bored she was in physical science regardless of the content of the unit.

Biology. The biology teachers see the student interest in their required course a bit differently. They think their content is more directly useful in life for the young adolescent. Younger staff members emphasize the need to find links between the content and the lives of students. One veteran teacher agrees with the need to change.

> *When I started teaching biology I used to teach them the parts of the ear. Now I stress personal health, diseases of the ear, trauma induced by stereo blasting.*

And the difference of being a year older is not to be taken lightly. Several teachers in the science department said that ninth graders were the problem--not the science course that was slotted there.

Another thing that biology has going for it is its breadth. Because it is a survey course, "You can always find something that you and kids like and give it a push." One teacher would have every teacher feature her "long suit."

> *We should spend a lot more time on genetics because that's where everything comes from in the first place. Every problem, any of your syndromes, mental diseases.*

On the other hand we can see the breadth of the course as being its shortcoming.

> *Biology I is a survey course in [college] biology, that's what it is. It reminds me of my freshman biology class. I should hand them my old notes. We just cover everything and it is too much. Two days of lab leaves three days to read the whole field.*

A final quote from a teacher who started to tell us about the increasing quality of her students and ended saying something else:

> *The kids are getting better and better in Biology I. They know how to do my tests. They know where I am going. Some of them have had me before. They can read me.*

Chemistry and Physics. If you missed the quote near the end of a previous section on "What's the big idea in science?" here it is: "The top of the pyramid. The place where all their math and science come together." Physics is the elite course in the minds of the top science students, the counselors, the bottom students who will never take it and the instructors who offer it.

It is classical in content and approach. The modern physics curricula did not catch on in River Acres. This teacher has been building up her materials for instruction for the past four years. She has "raided several textbooks" in the process and is now satisfied with what she has on hand.

> *Classical physics is what I stress. They can see classical physics. There are demonstrations they can see, understand, draw a picture of. Modern physics leaves the student out on a conceptual limb. Quantum and relativity cannot be seen. And perhaps what is most important for the introduction of students to physics, they cannot feel them [quantum and relativity].*

I heard her teach a class for an hour while I worked in an adjoining room. She is an effective question poser. Works hard to get students to "think out loud" about physical relationships, about causation, about explanatory mechanisms. I also watched her work after school one night with a "last semester flunk" who is auditing her course this quarter. Socratic inquiry was obvious as she worked with the youngster. I asked her about giving Newton's laws, definitions, etc., without an experimental basis in the laboratory for kids to discover intuitions. The teacher said she knew about all that point of view but had rejected it.

> *Our whole science department is fed up with it [PSSC]. Investigation process wastes so much time. We end up telling them what they are looking for anyway; they cannot "pull it out." So I am putting my own course together and have developed my own materials.*

Her enrollments are up as they are in Chemistry. I asked the chairperson if the courses were getting easier and the students were sensing that?

> *It is not a "watering down" situation at all. If anything, the chemistry and physics are getting harder. The increase in numbers of students electing chemistry and physics is proportionate to the increase in enrollments.*

What is happening is the in-migration of students are principally from homes which are very much pro-chemistry. ("It is bringing you a better living.") One student said:

> *My father [chemical engineer] says that the United States is going to have to realize that we wouldn't have enough energy to even have a shortage if it weren't for the chemical industry. Not only that, physics is going to get America out of the energy crunch.*

Frequent, sporadic samples of students' attitudes toward chemistry and physics in the halls, lunchrooms, etc., found them generally positive and filled with the optimism of the student quoted above.

The attitudes are positive, and the worth of the course is not in contention; but at least one instructional problem in chemistry (and perhaps in physics) is apparent to three teachers. They spoke of the "mathematics trap" in Chemistry II as the principal undoing of some students. Students can "handle the science but the math is another thing."

> *Chem I the same: mathematics and reading is their bugaboo. Everyday math reasoning, the simplest functions they can't do. I can't explain it. There is not enough attention paid to application. They can hendle a polynomial but can't tell what to do with anything they know. They know their math. They want to be told when to use it. What do I do to solve this, Mrs. X? I can hardly wait to go back to plain math. The new math doesn't teach them how to do it.*

Science Teachers

There are strong opinions among this faculty about how teachers are trained--or should be trained.

> *Anybody who gets a degree in biology should have a course in genetics. Kids want to know why this kid over here has a big head. A Mongoloid. And we have one. Okay, explain to them and you need to know that there's a broken chromosome on the twenty-first to understand it. That's what science is. Why there is more retardation, more deformity that is now showing up? Explain brain damage.*

Another teacher of over five years in the district made this telling observation on staff selection for teaching high school science.

> *Loverly transcripts but poorly prepared in chemistry. Could run a class, maintain discipline. Lacked knowledge in chemistry. I promised myself that I was never going to take another education course. This [interview] is my one opportunity to scream; they are the most valueless courses in the whole world as far as I can tell. The only thing of value, and not much, was student teaching.*

A third, this one a biologist, broadly complimented Texas institutions of higher education for their efforts in teacher training and then pointed to an unaddressed aspect of her education.

> *I'm not as concerned with what to teach, or how to teach it, or how to order the curriculum as I am [with] how do students really learn science. That is going to be different from how students learn math, motor skills, other things. How do we get students to higher cognitive levels of synthesis, application? What kind of training do I need to get at this? Experience has not revealed that to me or to my colleagues.*

I would not be overstating the situation to say that the science faculty at Central High School in general thinks very little of the education courses they have taken; and if given the choice, few would take any in the future. The rare teacher mentioned anything about in-service training in the district and nothing congratulatory is in my notes on that score either. One teacher who works principally with level three students threw in a one-liner as she left one day that spoke reams about "the box" teachers are in. "Every day I try to squeeze in a few minutes to do some teaching."

Another science teacher says the enrollments have gone up, the courses are tougher and there's no problem with the parents. These have all been amply documented earlier. But he adds a special dimension:

> *In general, science has gone down over the past decade. We have changed the curriculum to try to adjust to this decline. In the 1960s I lectured, did everything "wrong" [according to comtemporary pedagogy] and my students loved it. High interest, high achievement. Now I am doing everything I know to recapture that interest. Changing my teaching, group discussions, student activities, films, kits. But it's gone, all gone.*

A personal review of the history of River Acres' science curriculum adds a comic touch:

> *Teachers, like most Americans, follow fads and change their minds. [In the sixties] we had labs with tables, sinks. We took them out, filled up the troughs with concrete. Two years later we brought the tables back, dug out the concrete, set up the labs again.*

One of the topics that one hears discussed among teachers trying to help one another is the "wild kids."

> *Kids are so wild. Including homeroom. Male teachers command more authority than do women 90% of the time. I would never survive without the support of the staff. Shared study sheets, tests, guides, materials. Level four means no discussion. So many anxious to erupt, disrupt. This bothers me that we can't discuss. Every teacher has told me that it is impossible to discuss things with this level. I feel guilty keeping them busy because I don't consider that good teaching. There should be a half and half.*

One new teacher (to the building) said she would have quit if it were not for the support of her colleagues during the first few weeks of her teaching. She also shared with me her view of an established teacher that went beyond perspective and skill:

> *The big difference between the established teacher and me is not expertise, insight or skill. It is the enromous backlog of materials, lessons that work, files that they can rely on to get them through the day or week.*

Another rookie said he was stunned by the "get ready" time involved in setting up labs. Sharing of lab space with other teachers makes setting up labs difficult to impossible for certain activities. So it all has to be done within one period. There are other worries, too: "Spend a lot of time getting labs together, taking roll, handing out papers, it's very frustrating. Students don't want to come in and get ready."

Before turning to the matter of how the science curriculum connects up to the junior high school and elementary science curriculum in the minds of students and faculty, I'll add an item on homework in science teaching. It is obvious that the laboratory component of science teaching does not lend itself easily to homework. In Central High several courses are reported to have no formal (assigned) homework at all. One physical science teacher paraphrases the situation:

> *I don't give it. My smart ones don't need it. Many have jobs and don't have time. Others won't do it. A few could profit. Which few is the question. By the time I figure that out the quarter is gone.*

Cross-grade Communication

The beginning ninth-grade student strolls into what (for science and mathematics) has been called "the crunch," "Death Valley," and the "Second World War in two weeks." Physical science and Algebra I are the villains and the play has several science faculty reviewers.

> *Junior high teachers teach at the incoming student. We aim at the end product. There's no tomorrow after us, for many of them.*
>
> *We expect our elementary teachers to do everything expert in all disciplines. Most are weak in math and science.*
>
> *There is no formal teaching of science before the sixth grade in River Acres [untrue]. Now really, they could start teaching science in the third grade.*
>
> *It all depends on who you start with, not what or when. Science teaching should begin with good, interested teachers--not in the first grade, or with physical science.*

> *Beginning science formal teaching is probably not efficient before the eighth grade. I could teach all the science they [ninth graders] know in three weeks. It is a sense of maturity, or the ability to handle data and to think logically about them. They just can't handle the whole process intellectually or emotionally before the junior high. Most of them can't.*
>
> *The problem is they have gone over stuff. And over it. And over it. And never really know anything about it. But by the time they come to me [Biology I] they say, "We already had the cell!"*

A former junior high science teacher now teaching at Central talked about how she did it "down there" two years ago:

> *The junior high goes too much in detail. [She was curriculum chairman.] We were not supposed to emphasize things that the high school taught. But the general science taught in junior high is exactly the same as we teach in physical science at the senior high ninth grade (physics) part of it. They should be doing the preparation for it. It is too hard for them in the eighth grade.*

Students who are doing well in the ninth-grade physical science or tenth-grade biology ascribe their success in part to their junior high school teachers or to one elementary teacher who "made it fun" or "showed me how something worked for the first time." I was unable to get a student to recall precise concepts or discern a particular method of teaching science that could be associated with a success story. The failing students were nearly unanimous in their perception about how "we are never going to use any of this stuff"; and how "we know most of it but can't do well on the tests"; or "I never have liked science"; or how "I could learn it if I wanted to but there isn't any reason to, except to get a good grade, maybe." Not unexpectedly the courses and teachers were seen to be dull, or not to make sense, or not to be worth the effort.

While the successful student does not speak of the utility of the science courses in which she is currently excelling, her failing counterpart does speak to the lack of utility. Similarly, students who are highly successful in high school science at Central regularly point to an earlier experience that "turned them on," whereas their counterparts do not point to an adverse experience that "turned them off."

Help Wanted and Advice

Central High science teachers sent some strong messages to anyone who has a mind to read them. Those who attended NSF Institutes regard them, to the person, as the single most important influence on their professional development. Those younger teachers who have heard about them would like their chance. A retired junior high school coordinator who introduced a course in oceanography as a direct result of his attendance at an NSF Institute saw seven of his students (all boys) go on to colleges to study oceanography. (Two received degrees in marine science with a specialization in oceanography.)

The only untoward comment I heard throughout the litany of praise directed toward NSF Institutes took this form:

> *Frequently regular junior high school teachers demonstrated experiments to us and the kids [always introduced to us as a "regular eighth grade group of kids"] came up with the neat conclusions. I believe I was lied to at those Institutes. The techniques never did work out right back home. Wisconsin and Kentucky teachers said the same thing to me. It isn't the same back home. The deck was stacked somewhere. Teachers looked like they were doing things with the kids that they weren't maybe.*

A young teacher needs help in the marine biology course she is teaching.

> *I would love to have training directly in marine biology. Now I have to take a lot of superficial courses because of state certification. None of them will help me. I'd really love to go to an NSF Institute. A major institution in Houston offers a course in the physics of oceanography and one course in marine biology. No other institutions have more than two courses, even though we are on the Gulf.*

Biology teachers had a couple suggestions regarding the content of Biology I:

> *We have to teach so much subject matter and don't have enough time to teach stuff they can really use. I'd like to eliminate botany and emphasize ecology. De-emphasize taxonomies and emphasize population genetics. The exams in the department won't let me. We also have accountability to the state.*

There was individual concern that the sophomore course was not "sufficiently demanding for our most able students." (Recall the River Acres graduates' descriptions of the course as being rather easy.)

A physics teacher was not making a recommendation when she described the problem that follows. I infer she was calling for help. It concerns the matter of how mathematics and science are (not) connected in the minds of her students. I offer it as the end of the science picture in River Acres and as a lead into teaching and learning mathematics in Central High School.

> *Mathematics they do in that building and science they do in this building and ne'er the twain shall meet. They just don't take the understandings they get in math and transfer them to physics. I know they are getting it over there. I have gone over and talked and seen what they are getting. They are getting it. I taught the students linear motion. We went through the whole theory of linear motion. We did linear motion on the horizontal. We did free fall problems. We did, I did problems of all kinds until they were coming out of their ears and they could work them fine. [For two weeks to three weeks.] Then I spent a week working on vectors, just vectors, nothing else. Early in the semester we had worked on right triangles. And I worked with vectors strictly on the right triangle method. Well, they got the linear motion equation, they got vectors okay and we got to projectiles and they went "AAAGGH"! They didn't know what to do. It was something foreign to them. All it was was putting together the linear motion with the vectors. I would say 75% absolutely could not put them together. 75%! They knew everything. I can give them a vector and they can break it into the components. I can give them a linear motion problem and they can do it. Free fall, horizontal. But if I give them a projectile, something rolling off a desk they don't know what to do with it. I had an overhead projector with a transparency and spent a whole period and showed how it fell, okay. I had everything set up perfectly. And I had something shot upward; the velocity before it hit and the velocity as it shot upward, then I overlaid them, going up, coming down, same thing. And then I put the projectile over there and showed them that the projectile in the Y direction happened just as if you dropped it. And then in the X direction for every interval of time it moved with a constant velocity and it went in one ear and out the other for three out of four. [I gave them a test.] As soon as I gave them their test back and I said, "okay now let's do these together," everyone went, "Oh, is that what you wanted?" I had done several before the test. Now they know how to do projectiles, no problem. Good students. It's weird. What they want is a nice neat formula to plug in.*

Central High School Mathematics

> *Kids are struggling with algebra in our schools today that would not have taken it at all ten years back. There is a growing pressure to feed the kids to the next course. It is all wrapped up with the cumulative nature of mathematics that is in no other school subject. Sports, music have it, but they aren't required. Take science and social studies, for instance. Teachers in geography don't have to feed kids into history; or teachers in physical science don't feed kids into biology. Kids take different courses in those curricula and while good students in social studies and science tend to do well in social studies and science, there is no finger pointing or parental hue and cry if they do not. But once a kid breaks down along the mathematics trail, it's all over and everybody knows it.*

An administrator said it, but almost any River Acres math teacher would agree with much of it. The Texas guidelines say a senior high school must require at least six quarters (two years) of mathematics of its students. Thus, River Acres far exceeds the state's minimum requirements in mathematics. In the ninth grade students take either fundamentals of mathematics (FOM) or introductory algebra (IA) or Algebra I (ALG). The choice is important in that it determines a student's mathematics course for the next year as well.

In a real sense that assignment controls the mathematics curriculum for 95% of the students for their entire four years in Central. The students' career choice is made in the tenth grade. Counselors know some students make it unwittingly. Which courses and which levels cast the die. The distinction is this. FOM is a two-year sequence which reviews basic arithmetic. IA is also a two-year sequence in which the first year of algebra is "watered down" and is spread over two years. ALG is a three-quarter (one year) course based on the Dolciani series.

The tenth grade has a geometry course, which follows the Algebra I. The eleventh grade offering is ALG-II with computer science: a "major works program." The twelfth grade is trigonometry and introductory analysis and the calculus. There is also a liberal arts geometry and a liberal arts ALG-II which serve students who are college bound, but who will not require more mathematics in their vocation. It essentially enables them to meet college entrance requirements while taking a terminal course. The computer science laboratory is available but minimally-used by a handful of advanced students.

Algebra I

ALG-I is "the killer-diller"; "that damned course"; and "something I'm awfully proud of," depending on your informant. I visited a class, looked at the text, talked with several of its teachers and students and found it unremarkable. The teaching approach, the content, the exercises are what one expects to find in a pre-college algebra course.

But 50% of the students fail it. For many of the students who fail, it is the first time in their school lives they have failed a subject. "Social promotion's got to end somewhere," observes a young teacher. "The problem is it takes them down in other subjects," a counselor claims. The teachers say the problem is in the junior high school testing and placement programs, not in the high-school instruction. They see that many of the ALG-I students are rated more highly than they should be.

> *A lot of students are in ALG because their parents want them to have that status symbol. Some would be ready by their sophomore year but are immature when the choice has to be made. Our recommendations are overlooked or overruled.*

Another teacher adds that there is a student expectancy that contributes to his undoing.

> *Kids come into the class [ALG-I] in the ninth grade with a "right answer" orientation. What I spend a lot of time on is process. I mean I grade on the steps they use to get to any answer. They are dumbfounded.*

The students and parents are not storming the faculty gates on the matter. In fact, the greatest concern is expressed by, not about, the faculty. For students who make it past ALG-I, it is clear sailing.

Algebra II "used to be a boys' course" recalls a teacher of many years. "In fact twenty years ago it was four boys to every girl." Now it is elected equally by boys and girls. If there is a trend, it is in the direction of more girls electing it. But this is tricky to interpret since ALG-II has three levels. Level one is for the very top student. Computer science is integrated within the course. Level two is for the college bound who could take more math but are not likely. And level three (the liberal arts section) is for college-bound students who are not talented in the math area. Trend data for the ALG-II levels do not exist.

Fundamentals of Mathematics (FOM)

FOM is a terminal, two-year review of basic mathematics. It attracts a wide ability range of students. I watched a student in FOM level do a problem which called for the division of 51 by 3. He made seventeen marks and then counted them: 3+3+3 etc., and got there. In the same class I saw a student finish the assigned problems in less than ten minutes and spend twenty minutes talking with a neighbor. (His answers were correct.) For the most part the FOM student is weak in skills.

> *They don't know the vocabulary of mathematics. They don't know when you have 4 divided by 2 which number is on the outside and which is on the inside. But they really know their set theory. I think it is terrible. It is a tragedy; I really do.*

Introductory Algebra (IA)

Introductory algebra is the most maligned course in the mathematics curriculum. It exists as a "transcript course" to aid mathematically-inept River Acres students who need algebra on their record to gain college entrance.

> *Big push for everybody to go to college after high school accounts for a preposterous course such as IA. It is the state's "fault." The trend.*

Several students currently in IA told me that, "We are not getting a thing out of it"; that "It is boring and has no use"; and that, "It is okay because you have to have it [to get into college]." Not very high praise. But the teachers go them one better:

> *The two-year algebra course and lower level geometry [students] are really getting a junior or slow math course and call it algebra and geometry. There is no pay off for anyone beyond deceit. Students who do well in them have a difficult time in chemistry with mass: mass problems which are nothing more than junior high school ratio: proportion problems. We don't have enough level two students in the real algebra [one year] course. More marginal kids should be put in there. Half the kids in the two-year watered-down algebra and I want them there. They coast in class, are consumed by social problems and coast out of class. If they were really working at something their problems would be lessened all around.*

Geometry and Trigonometry

Geometry and trigonometry are courses that have the function, in part, of "getting them into college." About four years ago River Acres students were having trouble making it through the required geometry course. The decision was made to

> *. . . stress the verbal rather than the computational. It is a state-approved course and includes the history of mathematics. I had to develop the program and it is very difficult to develop a program you don't believe in. Then we were told to put level geometry on the computer, which was a disaster. These kids couldn't possibly go to college. It is a farce. Except that the college standards are getting lower every year so maybe they will make it.*

I asked a level three geometry teacher who said her section was doing "pretty well this quarter," if mathematics was either hard or boring for her students.

> *I have students who have absolutely no reasoning at all. They go to the kitchen and start to bake a cake and half way through they make spaghetti, if you get my meaning. For the student like that, mathematics is hard and boring.*

Again, it is crucial that one understands the level of the course the student is taking or the teacher is teaching. If one is discussing a level three geometry course then one is describing an element in a three-course sequence of Algebra 3 and Trigonometry 3 as well. There is no student choice in that sequence. (There could be switching between levels one and two, however.) It is of the "liberal arts level three" sections that the faculty contentiousness exists regarding these courses.

Math Analysis, Computer Science and The Calculus

Courses such as math analysis, computer science and the calculus are in a sense "liberal arts" sections and are generally praised highly by the teachers and the students. They are tough courses and the teachers are demanding. One morning I heard the following in a math analysis class (from a teacher whom the students and colleagues regard as a fine teacher):

> *Can't you people read?! Why don't you drop math analysis! It is going to get pickier and pickier as we go along [second week of the quarter]. You are going to have to learn the language and read it. If you say "onto" I don't know what you mean . . . what you know. There is only one way to write a definition; it is in your book. This is not a class in creativity; it's a class in clear thinking. In logic. I don't care if you have a personal definition. Do you know the definition that is mathematical? That's the question [shouts it]. You have a definition, she has a second one, he has a third. Mathematics cannot proceed in this way. You will get credit only if you write down the correct definition.*

A teacher shared her idea of what a mathematics analysis class should be in the context of describing some of her students who "shouldn't be there."

> *Can take his facts, translate them into mathematics symbols, and build a model to fit the facts. My students say their pre-calc course in college is a breeze. We introduce matrices in a couple weeks. We spend a lot of time on analytical geometry. We have kids in there who are there only because mom and dad push. They shouldn't be there.*

The calculus means that the student is in level one "major works" and is at least in the top 5% of his class. There are three routes for a student to end up with the cream of the crop: first, the student comes from the "zero group" in junior high; second, geometry is taken in summer school; or third, Geometry II and ALG-II are taken concurrently in the sophomore year. Whichever the route taken, the results are apparently the same: success. "A vast majority of the students who make it to calc pass it."

A word about computer science before turning to the instructional materials used in Central High mathematics. Computer science, like calculus, is alive and well if not growing. About six years ago there was one calculus class and there still is. Computer mathematics courses are never larger than ten students. Typically it is a "boys" course. Due to the small enrollment it is an independent study course, by teacher approval. "Since I am not there to supervise them [the terminal is located in another building], I do not approve very many." (The quarter I observed there were six students.) I learned of a "saved soul" that was attributable to the course.

> *I got a near drop-out hooked on a computer and kept him in school. Eventually, he went to college and is in architecture, winning honors.*

Instructional Materials in Mathematics

Mathematics instruction focuses on the textbook. Very little audio-visual is used and this is by teacher choice. For example, the use of hand-held calculators in school is forbidden for all except the top 5%.

> *College professors are standing up and advocating it. I think they had better think again. I do not allow it except in trig or analysis, where by that time they know their basics or they have faked a lot of people out. You waste more time doing arithmetic than doing the trig so they are allowed to use them there.*

A sample of the variety of reasons which teachers give for not supplementing the text follows. One River Acres teacher was involved in producing Texas television tapes for teaching high school math and doesn't use them:

> *Good time killers [she says]. I find that it is very hard for me to use these little neat gimmicks because I stay so busy trying to get them to work the problem. I did used to run a math lab in a different district where we used individual instruction on the students' own time. Tape cassettes, extra notebooks, overheads, in a one-to-one situation. But I want that personal contact with the students.*

> *If I put more effort into it I believe I could find them [visual aids]. I just have never used them.*

> *Textbook and blackboard and I'll tell you why. I hate to think of it like this but I hate to take a day out to show them a film. Films mean fun. Fun means nothing to learn. And that means a loss of a day. Then we don't get what we are expected [to do] finished.*

> *I'm not as good as I ought to be about using AV aids. I do a lot of drawing, demonstrating on the board. Colored chalk. I quiz them a lot on what they read. Make them read. They just don't know how to read a math book.*

> *I wrote up the geometry section on filmstrips [Curriculum Guide] and films but I've never used them. I do use the overhead.*

It is only the most personal hunch, but I believe the next story may be vital to understanding one dimension of River Acres. It reflects a fundamental view of inferiority held by the teller. How widespread, and how important it is for this story cannot be said. Because it was the only one of its kind I almost left it out. Indeed, it was the last entry made in the writing of this study:

> *I went to about six NSF scholarships in the summer. In fact I was offered one at the University of Illinois and they had a really good program. This was before the mid-sixties. There was all this emphasis on modern math. This was to be a crash program and I think we are still suffering from this. Teachers had to be retrained. It all looked good on paper. But to get in it and teach it was something else again. Let's take the student. An eighth grader had to be quite mature to handle the texts written for Algebra I. In Texas we use the Dolciani textbooks. About 85% of our schools used her series. I studied under her at Hunter College, by the way. It was a tremendous program.*
>
> *But the material is hard for our ninth graders. [It is intended for eighth.] You see here in the South I do not think we can take a book written by an Easterner and make our people handle it in the eighth grade. Now, we can handle it in the ninth grade--but how many [students] can? What percent? My guess [is] about 50% of our students can do it. It depends on what kind of people you have.*
>
> *Now that we have an influx of people moving in from the East maybe they will fit into this program.*

Teachers are not delighted with the textbooks they use. Specific shortcomings were noted by two teachers.

> *In general [elementary analysis, trig] certain concepts--nice, pretty things happen with them, but that's it--like absolute values and inequalities, are way overemphasized. Textbooks just don't have anywhere near enough examples, practical applications.*
>
> *Another example is the section on factoring. A big topic. Covered in three pages. Sixty-six problems thrown in together. We can't even use it. I have told my kids not to bring in their books for the next ten days. This will be the last thing I do with them. After ten days' work I'll give them this assignment.*

The purpose of IA is challenged by one new teacher in his comment on the IA text:

> *IA--don't like it. Should take the same ALG-I book and teach it in two years. The only modification would be to eliminate proofs. In IA you only get through tri-nomials, factoring, multiplying bi-nomials. You never get to rational expressions, nothing about irrational numbers [square roots, cube roots] and nothing about quadratic formulae. They will go to college unable to solve a quadratic equation.*

FOM texts are low on practice items, according to a third-year teacher.

> *One or two examples on percent. One or two on ratio and proportions. The deemphasis of percentage in the curriculum is downright dangerous. Many FOM students do better than ALG-II students.*

The geometry text for the level two students (used also with the level three students) was generally praised, as were the Algebra I and II texts with the sole demur that they may be "too theoretically abstract for some students." This and the lack of practice items and practical application items are the dominant criticisms of the math texts.

Concern about how these texts came to be used in River Acres was expressed by a few teachers. Teachers feel that textbook adoptions come too early and too late.

> *Why is it so frequent? I think what happens is that people write them and push them and that's why we have to re-select every six years. Not because we need to for mathematics.*

> *Once we get it, we are stuck for six years. I think we should have a trial year, or quarter at least, before adoption.*

The problem of selection is one that is felt deeply by a small group of the teachers. They see its roots in the publishing industry.

> *There aren't any good probability books for kids. Publishers ran through their college texts and threw together high school texts for the state adoption list.*

> *A lot of the stuff put in high school mathematics books is not useful; it's trash, not helpful. The selection at the state board level just could not involve trying out these materials in their own minds. They gave us three choices. So we chose the new edition of something we had already found to be terrible. I don't see how they could even have considered the other two books as algebra books.*

Cross-grade Communication

High school mathematics teachers do not share the desire expressed by their colleagues in the junior high and elementary schools for cross-grade communication. The high school teacher agrees it is not emphasized "in practice as much as it is on paper" in River Acres, but is not sure that is a bad thing necessarily. An extremely frank comment from a second-year teacher was:

> *I don't have to try to communicate with my elementary colleagues--I sat with them in the teacher education courses two years ago at the university. I know they don't know mathematics.*

Other teachers want an emphasis on the basic facts even if elementary teachers were uniformly high in mathematical ability.

> *I wish they were almost taught no theory down there. Back to basics. That means delaying teaching of theory.*

> *No algebra should be taught in junior high. Fortunately nature is on my side in that very little [algebra] can be taught in junior high. Verbal trappings for sure. Understanding almost never. And I know all about the super-zero students.*

A teacher of several years at Central recalled attempts of many years ago (early sixties) and prophesies the future.

> *Fifteen years ago we tried to enrich quick thinkers, not move them ahead in formal mathematics. Then we got into madness where everyone had to have algebra. But it became very apparent early that most of the kids could not "get it." So to get them in college we started giving higher grades, and creating algebra courses that weren't and aren't algebra. We now have arrived at a curriculum that produces A and B algebra students that get crushed in college mathematics. We reflect society. Now that the societal math/science panic is over we will nestle back to a more substantial mathematics curriculum for fewer students. Also we will get more rote learning back in the curriculum. Youngsters will be asked to add/subtract/multiply/divide without a calculator. So, they will know basic processes before they go into teaching them functions in the sixth grade, when they still can't add fractions*

> *or decimals. Another implication is for teacher training in elementary school. The elementary teacher needs to know what the child is heading toward; math analysis, trig, calculus, second-year algebra, so that this [elementary school] year makes long-term sense to them. So they can tell where a child is heading in his mathematical thinking.*

An effort to bring the elementary, junior and senior high mathematics teachers together was made in recent history. One who attended the meeting said:

> *We had the [articulation] meeting in October of 1975. We discussed where our problems lay. And we have heard nothing since then. We need to know more as they do. The administration has not followed up on it.*

Most of the expressed concern focuses on the junior high school mathematics curriculum and instruction.

> *For some reason in this district [I've been in three school districts and this is the worst one on this count] the kids coming into the ninth grade are not as well prepared as they should be.*

> *The shift away from basic facts; the trend toward earlier and earlier introduction of abstract mathematics; it's not poor teaching.*

> *Fifty percent of my classes had been taught that you divide, get the whole number and precede the remainder with a decimal. It cropped up everywhere. We took a survey, found out the kids that did it, found out where they had learned it. It was like we had to set up a disease control center and track it down. Came from two math teachers in junior high school--both are gone, fortunately. But their virus lingered on.*

Teachers and administrators see other barriers to improving articulation (if indeed, it is desirable):

> *As long as you run a school on a "no child can flunk" basis, all kinds of deceitful grading practices will occur. Before the ninth grade the [letter] grades don't count. So our ninth grade comes as a shock.*

Instructional Levels

This raging issue in the minds of a few teachers and administrators was quelled in Central High mathematics: levels are necessary and good. "A few students are misplaced" (estimates ranged from one to five in a class of thirty-two), and the level four students are believed by about half the faculty to need an improved curriculum. But the issue is not whether there should be a level four, or whether the students belong in that level.

Several teachers reported their level four students to have "given up," but the level three student is ofter described as "lazy." "Ninety-five percent of them could do level two work," observed an FOM teacher of three years with several level three students.

In addition to the widespread observation by teachers (and by level four students themselves) that reading is a problem in mathematics, teachers say students are unable to "stay with it" during a period of instruction.

> *Especially for the 4s you can get a little bit done at the blackboard and then you had better get your handouts out real quick. Level 4s need the materials the most and you can't use the materials you know they could benefit from. It's too bad.*

All in all, the "good probably outweighs the bad."

> *Best students can be more readily challenged. Weakest could be worked with more easily, too. From the teacher's standpoint homogeneous groups are good. [I'm] not sure from the student's standpoint.*
>
> *Once the ninth grader is settled in a track they pretty much stay there from then on. Even when changes are necessary the schedule may not permit it.*
>
> *Concept is good; the weaknesses come in when students are misleveled; when parents intervene; when classes are filled above or below so we can't re-level a student. If they flunk the first quarter of a math course they are not supposed to go on to the next quarter in Texas.*

A young staff member combined his view of the necessity for levels with the open-space idea. (Open space was mentioned only one other time in passing.)

> *You have got to break it somewhere. But how to decide that this guy is going to take ALG-I and this guy is going to take IA is hard. There is a large group of kids who could go either way. I have always said I never wanted to teach in an open-area concept when there is no leveling and everyone works at their own rate. But in a way I like that idea because I can see the possibility of reaching more kids. My idea is to have part of it closed. Take a group into a closed room, lecture, demonstrate--then go back into the open area for practice, resources and let them work at their own rate. Then you could see each student's needs.*

Teachers and Teaching

> *I am a very traditional teacher. I use chalkboard, a textbook and handouts.*

If half the faculty did not say this precisely, they came close. I believe it is a fair representation of the faculty's pedagogical style. Another characteristic is "staying with it." The major works and level-two sections are on-task, no-nonsense experiences according to teachers and students. The only verified instances of non-instruction were with level four sections; e.g., I noted students standing around joking in one math classroom for over ten minutes. Students described one class as a "nothing course." All informants and my experience say that is exceptional and that a vast majority of the teaching is tough, demanding, persistent.

> *Administrators and counselors say teachers in general do not for the most part utilize or know how to obtain information about their students from the standardized tests given. Teachers say the information is not useful. They say it does not aid in instruction because it tells them nothing they did not already know after two weeks of instruction and in no way implies how to remedy deficiencies that they already knew existed.*

A mathematics teacher who taught several years of high school science before joining the River Acres faculty as a mathematics teacher stunned me at the soft drink machine one morning.

> *I talked last night to my wife about your interview and we wondered what you think about this. Since it is common knowledge that most students will not understand nor appreciate . . . nor just plain like mathematics by the end of the junior high school, what kind of a person consciously selects a teaching career in mathematics in the high school?*

I don't want to think about that. The split faculty and split resources due to the double-building school plant are troublesome for the department head.

> *Building arrangement is maddening. Can't keep in touch. Supervision cut back. Divisional organization is imperative. Assistant department heads become very important in subject areas. Of the four areas, one is going very well [ALG, FOM/IA, GEOM, CALC]. Almost no time to pay to total curriculum.*

Scheduling is monitored carefully. For example, geometry and algebra are taught so everyone tests on the same day, the same content. Never more than a period ahead or behind the other section(s). The schedule also affects the teacher's approach. It results in keeping all sections together. Faculty approve of it for students' transfer sake; disapprove of it because it limits instructional flexibility and opportunism. "Wednesday is test day and your kids won't be ready for the departmental content if you are too individualistic."

An identical testing plan to that in the junior high schools is followed with one day a week designated for departmental testing. A less-than-perfect computerized schedule brought the wrath of one.

> *We have a computer program with scheduling problems. I don't think we are getting our money's worth. A good programmer and program could tell us where in the curriculum during a certain time someone was doing division of decimals. Then if you had a kid in trouble with that he could go into that section just for that skill development--then return to his course. But everyone throws up their hands and says "oh, that's too much of a scheduling problem." Others have figured it out. What's our problem?*

The life of the mathematics teacher is not necessarily easy in a school when the upper levels of algebra have high failure and the lower levels of IA and FOM are filled with students who could not care less about school mathematics.

> *The teachers get to the point where they don't want to rock the boat. [But] the sea wears the rock and they finally give in to the need for student love. It's no fun being called a tough bitch year after year. Some day nearly every mathematics teacher has to give in or give up, I would suppose.*
>
> *The administration wants things to look good on paper. All A's mean fine tobacco.*

The kind of group support to be described next in the social studies section was not in widespread evidence in the mathematics department. Some faculty felt "that is par for math teachers." Two teachers in one section, however, did report sharing materials, tests and ideas in their section.

An interesting fact of instructional life was mentioned by two math teachers. They said that men teachers tended to receive lower-level class assignments to lessen discipline problems. "My comment to the ladies is if you want to be a teacher, start sticking your neck out," advises a middle-aged male teacher. Others verified the assertion that male teachers do have fewer discipline problems in mathematics teaching at Central. An additional and related item is that there is a seniority system in effect with the more senior staff more likely to receive their course preferences: "You work your way slowly to the top" are the words of a relatively new teacher.

When you get to the top and look back, as did one teacher of excellent repute, you may take pride in your relationships with students.

> *I'm proudest of the rapport I have maintained over the twenty years I have taught. If I won't learn anything this year then I should quit. Mathematics is dry--but kids can enjoy a class or a course.*

She said "dry," others say "dead," most say "boring." The pedagogical complement to student boredom is repetition--but it is necessary. One teacher confided she went into math education because she found it "unnecessarily hard and boring as a student."

> *Hard and boring. That's why I got into math. Trying how to figure out how to make it not boring. I have been disillusioned. It is a drag.*

Another describes student boredom as a natural event.

> *I'd have to put "boring" first. The subject matter is hard for an awful lot of the students. In my [top level] ALG class yesterday the first presentation [to thirty-three kids], fifteen of them [snaps her fingers] got it. Now they are going to be bored while I work to pick up the rest. [Two days on the binomial!]*

Others disagree that math is necessarily boring. One, a young male teacher, analyzed it this way.

> *The less able the student, the more likely math is to be boring. It is that simple. Think about it. It gets to be boring when something never makes sense to you and it keeps coming at you and coming at you. It also gets to be hard when you never get the right answer. Able students find mathematics sensible and because they do work at it and get the right answer rather often, which in turn increases the sensibility. It's a tautology--but it's a factual one.*

The joy of teaching came through a conversation with an upper level senior mathematics class teacher.

> *When some of my students raise their hands I know I am going to learn something. When they say, "What if . . ." I know I am in trouble. And that is exciting. When they say, "I need some help," I know I am going to have to think or study a little more myself. The challenge of the less able student is to get them to see the wonder of mathematics. To see the puzzle. To catch the excitement.*

The agony of trying and not succeeding was in the observation of a younger geometry (liberal arts) teacher who had tried to be inventive in his approach a few years earlier. He now puts

> *. . . less emphasis on algebraic proofs. Too much [for work of teacher], too little return at freshman level. Less emphasis on creative stuff; we had them on a computer, had them doing papers on the history of math. We cut out all these things over the past three years as a waste of time. They couldn't do a geometric proof after they wrote their papers, did their macrame, worked on geometric problems on the computer. They could not understand; they did not have the logic.*

The puzzlement of what works today but may never again is described:

> *When the light goes on for a kid I ask, "What did I just say? Tell me, so I can use it next period [illegible] It doesn't work next period, of course. Today we were doing the expansion of binomials. We had done the usual background work on this. So I was giving them Pascal's triangle and some of them caught that rhythm just as soon as I put it down. Others were saying what, hey, where are those numbers coming from? So, we work on it together and alone. We lost some of them and came back and did some more--then one said, "Oh, I get it!" Then a couple others. I don't know really how that happens.*

I discussed the results of a class with a lively math teacher who had brought in Descartes and "what a peculiar guy Pascal was" into her work that day. She had discussed the personal interests of Pascal. She startled me:

> *By the way, this sort of teaching turns some of them off as well as on. Some want to get on with the mathematics. One said after my class, "I get enough history stories third period. I get mixed up when the teachers start mixing up the subjects like that."*

Modern Math

"There's something everyone can agree on" (followed by a Bronx cheer), quips an algebra teacher. Several of his colleagues agree. The reasons for panning modern mathematics are many. First, a teacher of seventeen years:

> *Most teachers have no idea what it was all about, unless trained in it. Manipulation of bases made sense to me. The practical use of that in computers is easily seen. But it did not strengthen the understanding of most of our students. It confused them and momma and daddy.*

Next, a teacher of three years:

> *I was taught modern math in the fifth and sixth grade so it doesn't seem modern to me.*

Hear now a new teacher who shifted from another career field:

> *In my mind modern mathematics was an unfortunate hoax.*

Another, an FOM teacher, said modern math makes him "a star with the students."

> *I show the students the old quick, efficient, easy ways to get the job done. When they come to me they have no understanding and no ways to compute. By God, they might not understand when they leave, but they do have a way to divide, compute interest, whatever.*

A young male teacher of ALG level two:

> *I see no reason for teaching anyone what a set is in the first few grades. I have seen my younger brothers and sisters who can grasp $X+5=10$. They know that 5 is to be taken from both sides. What they don't know is that $10-5=5$. They can't do the arithmetic.*

Another old pro whose principal work is with the bottom level student shouted:

> *I have [level] 4s, mind you 4s, who are great on set theory, just great; and they can't add or subtract. They do not multiply these, only "times." They multiply everything times the divisor instead of doing long division. Can you believe it? They have the most incredible schemes for figuring out what they are going to put up on the top. It is the most incredible deficiency I can imagine.*

The list could, and did, go on. The pump was primed: all I needed to say was "modern math."

The Students

We have as strong a math curriculum as the child can stand.

"What students can stand" is an issue in River Acres. The faculty and administration see it one way, the students another. The issue is joined where students, teachers and others hold a common view. First, here are a few things mathematics faculty say about their students.

> *Some of my kids who can compute area satisfactorily on a test really cannot see that calculating running feet of wallpaper has any direct correspondence to computing wall surface area. They know that you do this, and then that, and it works out. But they tell me honestly they cannot see why it does. It just does.*

> *I have students who have very poor ability who love math. They don't get anywhere near as much as they could and should from me in ALG-II. They should not be in there. There is also the group of kids who do very well but* hate *it.*

> *One student told me "I've been going to school for ten years and nobody's told me what percent means."*

In the eyes of a few teachers, students of the seventies are changing--not always for the better. First a little pointed humor.

> *If you put problems in a money context with junior and senior high kids, be sure to make it more than ten dollars--because anything less than that isn't worth figuring out.*

> *They don't know what 6 times 25 is; but if you say 6 quarters they know in a real hurry.*

Followed by a little sick humor:

> *Just come on by my office and we'll clean the scum off the front steps.*

And now a dash of historical wryness:

> *Level three mathematics was the name of a course [and level four was for tenth graders]. Level three was for kids from minus one percentile to tenth percentile. Yes, minus one percentile.*

Which brings us back to the student of today. The day I interviewed this teacher she had a student

> *. . . transfer out of level two to three because his own business was taking more time [landscaping, own truck, business cards]. An increasing number are working. Before, the prison, a local manufacturing industry, and [the] farm was it for work as an adolescent. Now there are 100 employers in ten miles; and a car makes it ten minutes away.*

> *The last two years have shown marked improvement on part of the kids. The new kids bringing up achievement.*

Another facet of today, a vestige of an era past are the "kickers."

> *Cowboys, teachers were the law. Do what they say. Drink beer, forget college. Structured. In line. They were minority White. They are getting lost in the shuffle.*

> *The new-White, college-bound, teacher-be-damned [are] loose. Their parents raise hell with the administration. So the new courses are invented. The grades don't go down. And the seniors in probability see 1/2 squared, as 1.*

The girls' entry into upper-level high school math courses is another part of the seventies that was mentioned repeatedly. Reports a woman:

> *Even boy/girl split. When you find the girl that is good in mathematics she'll usually take the top off it. But it all depends on the way the mind works--not sex linked.*

Reports a man:

> *Girls: higher in interest, better in computation; boys better in abstraction in the top levels. In the lower ones, no difference.*
>
> *Girls are now 50-50 in ALG-II. They are very interested in math but are not trained in logical thinking [reports another man].*

The men and women teachers, without exception, saw the girl students' upper-level math abilities differently. I asked a woman teacher "why?" She said it was only a "matter of getting used to it." She recalled:

> *I felt like an oddball in mathematics at the University of Texas. [She was the only girl in her last courses--particularly in the engineering applications courses.]*

Parents

The parents of River Acres students are not vitally involved in the math curriculum. Those few instances in which they were mentioned by teachers took this form:

> *It depends on which parent has been complaining. When a filling station operator comes in, the principal is on my side. When a Texas Instrument parent complains, now we have a problem.*
>
> *Parents always win regarding levels. After all this is a* public *[long drawl] school.*

A counselor said he told half his advisees they probably should not take ALG-I. They did anyway. "Parents urge them and then us. I put a slip in the file saying the parents demanded it."

A rare teacher (in her eleventh year) was actively trying to communicate with the parents of her students.

> *I send notes home every three weeks to all my parents about all their kids. All their daily grades and tests for that period plus a written comment on occasion. [One parent wrote her back a lengthy appreciative response.]*

Now, a Word from Our Consumers

A spate of student comment on math teaching and learning in River Acres patterns nicely into, "I don't get it" (levels three and four); "How am I going to use this?" (levels one and two); and "It's boring and there's too much homework" (levels one, two, three, four).

An outstanding exception to the boredom rap was offered by a calculus student whose opinion is changing:

> *Mathematics is hard. But it is such a nice feeling when I get it right. Hey, it makes me feel good! Ms. X never lets us know what we are going to do next so it doesn't get boring. There is enough repeat of problems to get it, not too much. Overall mathematics has been boring from the elementary school on--but this course: trig, calc, math analysis, has not been boring. [There were several students who made this distinction.]*

Chance comments by students that stuck out in their interviews were:

> *What gets me about a math teacher is he won't explain, he tells you but he doesn't really explain.*
>
> *Math teachers scare me.*
>
> *Math is something that you just have to use or it seeps away.*
>
> *The mathematics department demands too much--but I feel I got a good background [college]. [For the non-college student], I didn't get a thing out of it. It was boring.*

Students said that math is really the only course where student cruelty one to another is tolerated by teachers. They made this point in recollecting elementary school embarrassments at the board, being called on, etc. Students joined teachers in decrying modern mathematics. Interestingly enough none discussed "back to the basics"--but modern math was on the tips of their tongues.

> *When they figured out how to divide thataway we took one huge step backwards instead of one for mankind. My daddy says they started this because the Russians were going to beat us to the moon. He showed me how to divide faster, easier and I am right more times. I agree with him that modern math stinks. My problem is that my teacher won't give me any credit for doing it the quick way. I have showed my friends how to do it too.*
>
> *Commutative, associative, distributive. They don't mean anything. They don't help you to solve problems. You just have to learn them.*

Kids say that you can't really understand mathematics unless you are willing to put in hours every night. "Even then there's no guarantee that you will get it," said one girl. "It is the only subject that is like that. The chances are that you won't get it and it is so much work to try." And for what? "So you can do mathematics. I don't want to do mathematics in the first place," said one boy. "Teachers even admit it was hard for them to learn. The only thing they do is teach it to other kids."

> *They say how good it feels when they work out a problem. I have lots of ways to feel good [laughter]. No, I mean legal ways. Teachers think that mathematics is something great. Good for them.*

Another girl:

> *I haven't heard anyone, anyone except a mathematics teacher say that math is great. You gotta know how to figure your income tax; how to get money from banks, how to buy or sell stuff, know the stock market and maybe a couple other things and that is it.*
>
> *(The first girl adds) Everything in the world on television, "60 Minutes" for example, is not hard mathematics. The news shows and all, I mean what is all this stuff for except more of it. I am not going to teach mathematics. I am not going to do that stuff. Almost nobody is. It is like a God and you are supposed to believe in it.*

That would certainly qualify, but I chose not to include it as an item in the next topic.

What's The Big Idea?

First, a surprise. Only one teacher in River Acres said anything about the principal idea in mathematics being related to what a teacher does. This from an ALG-II level three teacher:

> *Looking up [materials] that just don't roll off your tongue. I hope my students learn to do that and can use that. I go into a trigonometry class without having worked out the identities earlier or the proofs in the Algebra II. So they can see me stumble through the process. See what I do when I hit a brick wall in logic. How I double back, where I check.*
>
> *I hope they have learned that [the process] when they mix their babies' formula; figure out how to buy their house paint; decide on loans; and look at their PSAT scores.*

Second, another surprise: some teachers who agree with the students that higher math is not useful (beyond taking more mathematics).

> *I agree with them. Eighty percent of what I teach my level three algebra class* *cannot* *be used by 90% of the kids. The benefit [only] is to get into college. I can teach them to think logically about real problems in their lives today. I sit in my own graduate courses in mathematics at the university [illegible] myself, what am I ever going to use this for?*
>
> *Calculus. When a kid is through he has an understanding of limits and can advance place in college at least six hours of mathematics. That's it.*

The plurality: six teachers' views of what mathematics is all about at River Acres is the major theme found throughout the study: to teach kids to think logically.

I read the following poem to one of the teachers. She said it ought to be on the wall of every mathematics teacher's room. "The kids who knew what it meant would get an A."

LET US READ ARISTOTLE

Let us read Aristotle in the evenings
Until we know
How to approach
An idea
And cleanly cut to its center
As we would a cantaloupe
The beauty of the melon
Touching our blade
With its cool being
Scenting the air--
Sweet and good
When we've done.

James P. White

But the rarity of seeing the big idea in real life is what the teachers talked about.

> *Mathematics can teach the student how to think logically and that process can carry over to anything. To be able to start with a set of facts and reason through to a conclusion is a powerful skill to have.*
>
> *If a student can go through a problem and think it through logically step by step, that is a thrill! I am displeased when they have not learned their basic [arithmetic] concepts. Frankly who cares if they can remember the theorem that proves triangles congruent? The point of what we are doing is to help them learn an approach to any kind of problem that they've got. I don't limit my classes to geometry per se. We cover the work and do extended logical thinking.*

One teacher asserted her major purpose lay in the application of math.

> *Not exposure, rather it's learning what can be applied in the real world. Can he use algebra in figuring the rafters on a building? Not knowing the theory in high school hasn't hurt me. I knew how to use math long before I was told about the great abstractions behind it.*

I conclude this presentation of math's purposes with a group of three teachers who have lower-level courses and sections.

> *I want them to know when they're getting ripped off.*
>
> *If they can balance their checkbook, I'll rest in peace.*
>
> *How to use money in a capitalistic society--that's math with a bang!*

Help Wanted and Advice

On the math faculty's Christmas wish list were smaller classes, an overhead projector in each room and more NSF summer institutes. Adjustments in the curriculum were advised.

> *We have music teachers who go from grade to grade because they can play the piano [in elementary schools]. Why not have a math teacher going from grade to grade because she knows her mathematics.*
>
> *Elementary mathematics teachers may know how to teach mathematics but they don't know mathematics. Really, I guess they don't know how to teach it either if they don't know it [mathematics].*
>
> *I need more application examples from everyday business. That's where most of my students are heading, where their fathers are. They want to know more applications than I can give them. I know they exist. I know the theory but go blank when more applications are required [calculus, trig, ALG-II applications]. I can sit down and grind it out with them. We need some training in business.*
>
> *We need to be more concrete in our applications in our most theoretical courses. Trig and the calculus for example. The reason that we are not is a lot of us do not know such applications.*
>
> *In this district and in others we don't stress basics. More and more teachers in all districts around here [are doing it]. I asked my classes how many of them have savings accounts. About 75% do as freshmen. I asked them if you had $3000 saved and the bank was paying 5 1/4% per year, how much would you make? I had two or three in each class that could tell me how their money earned. Percentage is a basic idea that you have to learn.*

One cared enough to send a message to teacher educators:

> *I had no preparation to deal with level 4s--even 3s. I just never knew how hard it would be. Times and kids are changing. One day we discussed retarded children in my mathematics class. I think they learned something and it might keep their interest in coming to the next class. One kid finishes in five minutes and another works the whole fifty minutes on the same problem. I am learning by the see-and-do method. I think maybe a special education course.*
>
> *Part of it is the frustration, the extreme disappointment; you need preparation for this. You've taught them, they've known it, they've been tested on it; they've succeeded, and two weeks later they don't know it anymore. That kind of preparation would be awfully hard.*

I got some unwanted advice in the guise of Texas humor one day in the math teachers' conference room.

> *Teacher:* *Are there going to be some more monumental sweeping changes as a result of your study?*
>
> *Denny:* *Not likely.*
>
> *Teacher:* *Good. I'd like to see researchers' sweeping changes swept away.*

The department clock in mathematics was 10:00 when I began this study and when I left River Acres. Mathematics instruction is timeless but I'll offer a direct piece of advice to River Acres anyway: "Fix your clock."

Central High School Social Studies

The course curriculum in the social studies begins at the tenth grade for most students with world history. This is required as is the eleventh-grade U.S. history. In the twelfth grade most of the students take a two-quarter economics/one-quarter required government course. In addition there is an advanced placement (college) U.S. history offering for the very able twelfth grade and psychology and sociology courses which are not leveled. A very small number (2%) take a "major works" world history course in the tenth grade.

In addition to the course curriculum a group of about twenty students is sent from Central to visit the federal government in action each year. In a similar manner the federal building in Houston is visited once a year by a group of seniors.

A year or two ago, a Latin American history course was offered in anticipation of interest by the Mexican-American students and perhaps the Anglo students. It was cancelled due to lack of enrollees (they needed fourteen).

The task of covering U.S. history in a year is a tough one according to several teachers. They attack it in various ways. "On your mark, get set, go, is my approach," confided one. A second said, "Trying to teach from day 1 to 1976 in one course in one year is impossible. So I skip Africa and the Incas." Newer approaches are being tried by individual teachers. "It used to be Betsy Ross sewed the first flag and Nathan Hale regretting the number of lives he had. Now I am more into 'whys' and 'ideas' with dates not stressed." I asked a group of teachers if they were worried about making social studies more relevant to their students. One said, "We sure can't go out and hang ourselves to get a hanging experience."

Most Central social studies teachers use a lecture-discussion approach to their textbook curriculum.

> *We live with texts for five years. Next year we get a new text in world civ. "No fewer than two, no more than five" is the selection committee's charge. Old texts go to the shredder. Too bad, we could use parts of them.*

There is an on-going effort to regularize the scheduling of topics within a course. Coordination is sought so that if an outside activity requires a student to transfer from one class to another, that student will not lose time. An administrator describes two U.S. history sections:

> *At the end of the first quarter one teacher might be teaching World War I, another the post-Civil War period, and a third the Columbian period. Literally true. Now that is independence that is intolerable. When a kid has to move from one course to another he should move from Jacksonian democracy to Jacksonian democracy.*

I checked this out with a group of seniors who had been in different U.S. history sections (all level two and three). They agreed that sections are often not on the same schedule, but did not care about the problem as a teacher might. I shared the previous quotation with them.

> *It's no problem if they aren't exactly at the same place when we are. We don't really care. You can catch up if you have to. I don't see why it makes any difference anyway. My parents don't know the difference between Jacksonian and Jeffersonian democracy. They graduated from college and earn a lot more than Mr. X does. I know the difference and I guess it's important to know where people fit into government. You really don't have to know that it's called Jacksonian, do you?*
>
> *Anyway, that's not the point. The point is nobody really knows what difference any of this stuff makes after school [is completed].*

Curriculum organization has been hampered by the independence of the social studies teachers, the department heads, and the principals at the junior and senior high school, according to one high school teacher.

> *It's nice [individuality], but antagonistic to program development. We have tried to attack this for the last two years. The state requires us to use behavioral objectives to get on with it. Why? I don't know. No answers, just directives. Most of it is a waste of time. It will not actually be used. But it does force us to think about what is important in the social studies. We spent one fruitful hour on that and 100 to 150 hours in getting the words in the right order for sub-sub-sub objective forty-six. We don't have room for a "minor social studies event" like a Nixon resignation. No sub-objective for that one, but we have the third person in succession to become President pro-tem of the Senate. [He asked me if I knew who that was. I told him Nick Barf.]*

The district's efforts to regularize the curriculum through the development of a Guide which employs the writing of behavioral objectives has won few enthusiasts. "I think the district should get its money back from whomever was paid to write them," pined a second-year teacher (I said nothing).

> *The literature says that individual differences must be the base for the social studies. This district is going against the trend. Someone in this district has taken it upon himself to standardize everything. You can't do it in the social studies department. You get corralled into doing the same thing year after year.*

> *The pattern will be set and if the President is assassinated, I'm not supposed to dwell on it if it isn't in the curriculum. This year when I get to Rome in world history I'm going to stay there a while. Why? Because I am fired up about it. It is neat because I have just finished an intensive study of it. What will the behavioral objectives say about that? Try to write content objectives for current events sometime.*

Three teachers agreed that social studies ought not to be standardized, that performance objectives are of little merit. Of eighteen in the department, only one is known to think B.O. is useful.

More simply put, a member of the group that worked on the objectives said, "I shoved that in the closet a long time ago."

What's The Big Idea?

Well, for one thing it is not apt to be found in the psychology or sociology courses, which were described as "something we throw in to fill out their year's schedules because of the quarter system." An old hand advised, "Those courses aren't social studies. I don't count anything that wasn't here when I came here." Then there were the teachers' suggestions that the big ideas were appreciations of "cultures present and past," or

> *A way of thinking critically about issues for themselves and an eclectic view of the world. To satisfy the district all you have to do is be there and teach the textbook. But none of us are here for that. That is where we all start and our own individual identities, which cannot be standardized, take us beyond that.*

This view caught me unprepared:

> *The big ideas in social studies are not the most important; reading and writing are. But if you want to know what is really important look at the instructional budgets. What's important is athletics. They can shift kids by the bus-loads to games, to contests, matches, whatever because their instruction is important. We cannot take advantage of an opportunity when it pops up. When we ask for a trip for a class of students, the answer is no.*

Other nominees for the big idea in social studies were:

> *To know thyself and the functioning of our government; our economics and basically how to make a living. All are important to prepare the student for society.*
>
> *I try to point out how important people in history make their decisions on the basis of the information available to them. These kids have a hard time making decisions and history can help them.*
>
> *[Teacher] education courses stress the humanistic side but I think it's important for students to be educated, to be well rounded, to know something other than what he thinks is important. At age fifteen there are things that are important and at age twenty-five and forty there are things that are important. We should also teach social skills for citizenship. I must admit that I stress knowledge [acquisition]. I think it is important for someone to have knowledge. When I hear the broken record "Why do we have to learn all this, I'll never use this," I say, "Anybody who talks about the same thing all the time and cannot relate to what others are talking about, or can't relate to some quote or quip or reference is a sad thing."*

Instructional Levels

The top level is called "major works" and it exists only in the tenth-grade world history course. For the first time it has been offered in the twelfth grade as an advanced placement U.S. history course. The prerequisite is a B or better in English. I did not observe them nor did I talk with any students who had taken the course. The instructors obviously enjoyed talking about the "major works" courses.

Level two is called "the club" by some of the social studies faculty. It is comprised of students who are economically and socially in the "right group." Almost devoid of Blacks and Browns, these students pal around and go to the same after-school events together. They are seen as rarely taking school seriously. They exclude others from their group and the level three and level four students know this. ("The 4s have their own 'losers club,'" a science teacher observed previously.)

Two teachers of world history raised serious questions of how well the levels work in general but with special reference to the 3s and 4s.

> *I don't like my levels. I teach a level four class and they don't all belong in there. But they all turn out level four work. They think that's all that is expected of them. Academically there are students in there of the following varieties: cop outs, nonreaders, heavy personal problems, and others too numerous to classify.*
>
> *[Another teacher] . . . There are no criteria for levels. None of the counselors have come to me to ask if this kid is a level two, three, four [eight years]. A kid is in level four because somebody outside the classroom has designated them as a classroom level four. They say they can't learn on level three. That's a mistake. Within my level two class, I have two or three students that are super. The rest I could label level four.*

Another teacher of world history said he taught the same thing in level two and level three sections:

> *I just expect more from 2s. Level four is something else; it's hard. Deep down inside we know that they can't get the information or can't see any relevance at all. Most are slow readers. Many will not finish school. . . . And whether Alexander conquered 10,000 or four miles is not going to be important to them in where they are going. And yet they are required by state law to take a world history course. We would like them to conform as much as they can--but they have such a barrier.*

Another world history teacher of many years experience spoke with emotion about teaching the level fours.

> *I like to take them where they are and see if they can progress at all. I think it's the family environment and language barrier plus a lack of education in the home background. Try to see that they can be a useful citizen and contribute to the local government where they live. We have a unique unit in this economics which we call necro-economics. [He created it.] When we bring in a mortician to present the information you would be surprised to know how much good it does these kids to know about that, the cost of dying. It works well here.*

Another informant, a teacher new to the district, was "drawn to the district because of its leveling policy. One of the main reasons I came. It is the only way to really teach concepts and skills."

Two U.S. history teachers really got into it during a teachers' lounge discussion that I taped one afternoon. It points up the differences in how teachers approach the task of teaching level four sections in the same course. The first speaker is in her first year in the district, the second is in his tenth.

> *We are geared up for the college bound. Nobody could say we are doing anything beyond neglect for the lower end of the spectrum. We make them learn things that are certainly worthwhile but I think we need to get back [of the problem]. Teachers need things that don't exist. It is easier to redirect a learner in two [level] than it is to get a 4 going. First of all we need to get the group down, way down, to fifteen in a class.. You can find materials and adapt them if you can work with them. It doesn't seem to make any difference if I take a group of 4s and have to work with thirty of them using simple materials. They still can't read, you know. I have a couple sandbaggers that make me beware of labels. The lower-level kids are almost never taught by the better teachers who have been here for three or more years.*
>
> *I disagree. I taught level 4s and had smaller classes. You can't give them special materials. They want to be just like the level 2s. They want to carry around a book and not be singled out by this time. It does make a difference in the amount of discipline problems you have by having smaller classes. Mine never learned any better if there were thirty or fifteen. Head Start is the only way to help them--smaller classes in the junior year is too late. They are proud and don't want to sit around with kindergarten reading materials. It cannot be done in the school room in high school. You could put them with a very special kind of elementary school teacher who knows how to teach reading. We are not skilled in teaching reading.*

The department head justified the need for levels in quite practical and humanistic terms. In addition to levels he covered other ground as well.

> *Those kids give me a tremendous kick when they turn on really lively discussion. To see them start to read a newspaper for the first time. So I take it personally when something comes along that will keep me from doing the thing I love best, which is interacting personally with kids. We are in the people business. It is people we are teaching and not social studies, and we are teaching about people. Levels are ok because you can't have good discussions with a small number dominating the discussion, and that happens when you don't have levels.*

The Students

Change in student behavior attributable to recent growth in River Acres is discussed more by social studies than by the mathematics or science teachers. It is possible that social studies teachers merely talk more about students' social behavior since it is relevant to their field. Whatever the reasons I heard a lot about and from students in this department. In passing I note that I saw no different behavior on the parts of students in the social studies area that I did in the mathematics or science areas. My personal impressions were that they were a reasonable, mannerly, decent bunch. Some of the faculty did not share this view.

> *R-E-S-P-E-C-T--The kids sing it while they show complete insensitivity to the person who sits next to them, to one another in the halls; sadly, to themselves. Forget the adults. . . . Property, my gosh! It's there to be abused, tossed away. Don't you think for a minute I am talking about kids of color, or about the three- and four-level kids. I'm talking about kids, period. It's the executive's kids as surely as the bottom of the social ladder. The punishment isn't equal, though. One kid will get suspended and a second allowed to take a final exam for the same offense. That's how social class gets in the back door. [Band kids caught with grass on a road trip, Mexican-American kids caught with it on the parking lot.] Kids reflect the society in which they live. What we are looking at is our society.*

Another teacher, this one an old timer, said it was this year that he encountered his first verbal sparring match with a student; and a third decried students' attitudes toward homework. "Give them a homework assignment in history and they just get hysterical." "Economics, psychology, sociology, and world history, too," chimed in the two others. This general description checks out with other teachers and the students' views themselves. The principal factor which underlay many students' negative attitude toward homework was another kind of work.

> *Kids are getting more and more jobs. Getting good grades is not as important as getting money. These kids want out. Especially level three and four. They own cars or get to keep one that mommy and daddy give them. They aren't motivated to get good grades, to [then] get a good job, to then get money. They are motivated to get money today.*
>
> *We used to get 100 kids to see an agriculture film easy, twenty years ago. You can't get twenty-five to watch the governor of Texas ride a five-legged horse through their backyard. If you set something up here at school and it interferes with their favorite television program, you've "had it" so to speak.*

The television theme was a rich one and I pursued it for hours on end with faculty and students alike. Listen to an economics teacher first.

> *I put the blame for it [lack of work in social studies] on television. Children today learn by watching the television from the time they are two. They have to put out little effort from the time they see Sesame Street; they have to put out no effort to learn anything. They absorb it via constant penetration into their daily lives through television. They learn and they don't know they are [learning]. So when they get to a curriculum or study where the effort is necessary to learn they really can't understand why. [They say] "I'm a bright kid and I'm fifteen years old and I can't see why I should work to learn this stuff. What I know all came fairly easy because of exposure." When they get to a course like world history the only way you are going to be able to absorb any of this is by listening to the teacher, or by reading the book or seeing some audio-visuals. That's the only way you can internalize any of this. These are difficult things to do; they require concentrated effort on the kids' part to learn. They are not disciplined by the fifteen years of TV learning to put out disciplined effort. Learning has been easy in life. My own daughter has been an easy learner. School was easy because she knew it beforehand. The first time she had to learn anything it shook her up. It still does. For a lot of kids it takes failure in a couple courses to snap them up.*

Now listen to a group of level three senior students reply to the charge.

> *Teachers who complain about us watching TV and liking it and not liking school make me laugh. I mean, do they ever really look at themselves? It's hard here for them and for us. It [school] is mostly no fun. Teachers know it. They'd have to be blind not to. I guess mostly we are talking about a few teachers who can't see social studies on TV when it's there every night . . . more social studies there than in any book they got.*

Some of the students' and faculty's fingers point to the home, and to the parents when explanations are sought for the apparent change in student attitudes toward school.

> *I'll draw you a hard-edge picture of our incoming parents: they want straight A's for their daughters and good grades from their sons. They don't care where it comes from, what the kid learns. They want to see the grade. Do well on achievement exams, go to Yale and Harvard on full-time scholarships and have the boys be football and basketball heroes. And [daughters presumably] cheerleaders, rah, rah, rah.*

The picture is a bit overdrawn as the students see it, but they can see "some truth in it." One articulate "major works" senior said the "school was clinging to a day gone by, and we are living one not quite here." (I told him he should write poetry. He told me he did.)

Faculty and student criticism are joined on two issues: there are "faculty who do not like kids" and "faculty who do not expect kids to work." Two other criticisms made by faculty were not mentioned by students: "We do not have a way to insist that teachers remain alive" and "We have teachers who basically do not like the subject they teach." These four issues came forth in a discussion with six social studies teachers in the lounge as the principal self-criticisms that they would regard as being "serious and fair." (Note that they did not fault the students in any of these!)

Veteran teachers estimate sixty to seventy-five percent of the students who graduate will go to college. One estimated that as few as ten percent would finish college. Another way to bracket the college-bound students was offered by another old timer who said that "sixty percent of the [kids'] parents could afford it financially and twenty-five percent should go." The direction of the discrepancy is always the same: many more River Acres students will go to college than should, ought, want, or are prepared to.

Social studies teachers think that the achievement of girls is usually higher than that of the boys in all courses. There is no comparable feeling for differences in interest. There are

> *. . . always a couple boys who talk more than any girls, outspoken but not necessarily knowledgeable. Girls are just more reticent. A visitor to my class would get the wrong impression that the boys were more interested and knowledgeable from the interaction.*

A fourth-year teacher of U.S. history has her rule of thumb: "Girls are always for the grades, and boys are usually for the present interest." "Yeah, and the present interest is in the macabre," threw in a listener, "like the Bubonic plague; that's always a big hit." "Don't forget Auschwitz and Marie Antoinette," trilled another from the Coke machine. (It had been a long day.)

On a more serious note there is the matter of the interest and achievement of Black and Mexican-American students. "I always have one or two Blacks that are 'superstars' in my basic courses: smart, witty; but most of them will fail in their average classes." One teacher had this to say while two colleagues listened in apparent agreement.

> *I don't think they have much interest at all in the social studies. I believe you find many more of the Mexicans showing a lack of interest in it than the Blacks. They are not academically interested. They are more interested in the career fields, shop, vocation. When you look at your level four classes you see brown. We feel terrible about it and ask what the hell can we do? In the major works [level one] you rarely, I mean rarely, have a Mexican-American and very few Blacks. [This is River Acres' first year for a level one world history and its second for U.S. history.] A little more advanced level than average is level two; you will see very, very few Mexican-Americans or Blacks. Like in my classes I might have out of an average size of thirty, I'll have maybe one Black and one or two Mexican-Americans. [He estimates that in the district there are 15% Black and 15% Mexican Americans.] In level three, the average group, you see a few more [five or so] and then in level four it is 90% Black and Mexican American. They are reading . . . they don't go by IQ's particularly, but . . . they are slow, have a rough time, apathetic.*

> *[Beginning teacher] In my class of twenty-nine in American history I have three Blacks and two of them failed, and two Mexican Americans and both of them failed. In my average classes they usually fail. They are almost destined to. Three out of four chances. I am speaking strictly personally; it looks like an attempt of the counselors to try to move a few Mexicans and Blacks out of the basic classes into the average classes and they can't cut it.*

Cross-grade Communication and Back to the Basics

The discussion of the relationship of high school social studies to previous social studies instruction in grades K-8 could be dismissed flippantly: "We wave to one another on in-service days."

There is a bit more to it than that. It is related to the notion of "back to the basics" in several social studies teachers' minds. It goes something like this. Formal instruction in the social studies should begin in the first grade.

> *Democracy and our heritage for about five minutes a day. Democracy can't be taught in a course in the twelfth grade. Too late to begin to discuss citizenship, fairness in eleventh grade. "Back to Basics": Kids need to learn to read and write, to know what a continent and a river are, where Africa is, the difference between New England and England, the basics about rules in democracy, right and wrong and the law.*
>
> *Apathy and dishonesty are the symptoms of kids not having the social studies basics and we have the kids to show it. Evidently we are screwing up along the line. The best of them will cheat off of somebody else's exam if you don't watch them like a hawk. Copy someone else's homework.*

It was in the context of articulation that a rare mention of open-space teaching occurred. A young teacher said it was a "fantastic idea even though I have heard it is tough to implement." The veteran teacher said, "It is distracting. I couldn't stand it." The young teacher then continued, "It could never, never work with level four and probably never with three. But if they were started early it could work with the 1s and maybe with the 2s."

World history teachers regularly reported that their students had poor writing, research, listening and reasoning skills. (The students themselves supported the writing and listening deficiencies charge.) One world history teacher offered a most unusual interpretation of "back to the basics."

> *Back to the basics is the flag, the Pledge of Allegiance and George Washington never told a lie.*

For another, "back to the basics" means the demise of strategy and simulation games and similar techniques for teaching problem-solving analysis in the social studies.

> *[A student observes] School is a matter of sitting down and studying. [Another student] Like Mrs. X says, you got to take your medicine now if you want to get into a good college. That's what we are here for. The group projects and games and role playing stuff is not what we are here for.*

That delightful Texas brashness came through when I asked one of my final interviewees which of the several meanings he preferred in thinking about "back to the basics."

> *Whatever the hell it means we are all for it. If you get kids in social studies who cannot read or write or speak you're stuck. We waste so much time saying "right" on a wall map is "East." Any right is East, up is North. A continent is, the equator is, a peninsula. . . . Basic ideas such as culture, nationalism, how a bill becomes a law, what a constitution is, legislation, patriotism are foreign to them when they come to the tenth grade. I mean most of our students.*

The Teachers

The faculty is about evenly split numerically between world history, American history and the economics-government courses. This department evidenced more concern about the concept of accountability than did the combined mathematics and science faculty with a few other feeder schools thrown in for good measure.

> *Accountability is what is on my mind when I give out grades [level three courses]. If the teachers gave all A's the administration would be very happy. They are much more concerned about how parents think we are doing than about how we are doing.*

No one mentioned the use of the district's achievement testing program for accountability, or for instruction. An American history teacher said that accountability was going to result in a loss rather than a gain.

> *It means behavioral objectives, standardization, sameness. Why be a teacher if everyone has to use the same text, be on the same page the same day, teach for the same fact-objective? A part of learning the world we live in is learning to get along with lots of adults. Kids have to learn to adjust to the variety of approaches teachers have. Accountability is aimed at the bad teacher but it will miss him and hit the good one clean between the eyes.*
>
> *The bad teacher will now have to teach badly in an orderly fashion. If you don't mind my saying so, when the bad teacher gets his shit together it is still shit, ok? For the good teacher it is going to hurt them a lot. It'll douse their fire.*

Another spoke of accountability that had to be district-wide in the sense that a curriculum failure in the early grades would show up in teachers' work in the later grades. The problem is most readily anticipated for the level-four students.

> *He is there and nine times out of ten he doesn't care. You have to try to teach him the best you can but you cannot be held accountable for his learning. [Most of the level 4s are boys.] Most of the girls try hard. They just don't really have it. I worked with them. A new teacher comes in, is all idealistic about these slow students. They have come out of these education courses where they are all idealistic about these students without realizing what they really are like . . . what their home life is like. You've got to take that into consideration. I mean you can't expect a lot out of those students if you go and look at the homes they live in. No wonder they can't read; you see, you as a teacher can't change that. You've got to accept it. If you're going to help them, you help them before first grade.*

A final view has a dash of humor to blunt its barbed thrust.

> *Accountability is the taking of your textbook and writing objectives for everything. Your curriculum guide objectives, goals, I mean it's really just stupid. We ask, what are your goals; what is the learner supposed to learn? My God, what is he supposed to learn? He's supposed to learn the Civil War! I don't want to put it into a bunch of fancy words. A curriculum outline is good, needed: I can understand that.*

A young faculty member begins the following accountability quotation and a teacher of several years picks it up.

> *There is no academic environment to speak of. No personal competition. I am not speaking of who gets the best grades as a form of competition. I am speaking about "I am better today than I was yesterday. I know American history because I've studied it and I know how to learn more of it." I believe we are moving toward an increasingly anti-academic attitude in our school, while the student achievement is rising at the same time.*
>
> *[A second teacher says] The direction of teachers' time toward writing behavioral objectives to fit the text is more of the anit-intellectual attitude of the schools. I would just as soon they buy objectives from California ready-made and let us modify them as we see fit. I think work on the concept of quality of student work could make a difference in real academic work. Behavioral objectives don't make any difference--any positive difference.*

For all the criticism of student attitude and the teaching climate there was high praise for the spirit of academic freedom that the staff felt prevailed in their department. Student teachers commented on the faculty esprit de corps.

I saw several instances of the world history group helping one another, obviously enjoying being in school with one another (in front of the students!). Students commented on the ambiance of this section: "It is so obvious that they get along with each other that it is contagious." (I wondered if they had read the Faculty Handbook?)

FINAL MESSAGE FROM THE CLASSROOM

Conclusion needers will find these few observations unsatisfactory in that they represent overriding observations and concerns about what River Acres has done, is or will be doing. For the conclusion needers I offer the old saw: "For every complex human problem there is a neat, simple solution and it is almost always wrong." My last Texas poet reminds us of the puffery, fragility and fun of the author's task.

AUGUST 31

Inspiration   tense
climbs up my back and into my head
Got to turn them words right around
Strip 'em clean and let 'em strut their stuff
Get rhythm, words
Worddsss   worddsss   word them words
thas right Daddy   word them words
do a fine job now Pappy
jest gotta word them words hallelujah Honey
shit if them words aint got soul
jest watch 'em dance Mammy shoooee
word them words thas right Daddy
whoooee

Grady Hillman

In a way I wish I had met Miss Margaret the first day of my study. She said a lot in a few words. Two days before I left the district she came into the high school faculty lounge and asked me what I was doing in the school. I had been warned that "she would tell me how the cow ate the cabbage." I told her I was looking at teaching and talking with teachers about their ideas about science, math and the social studies. She was appropriately unimpressed.

> *If you're looking for crazy ideas, pass on brother. Those college people with crazy ideas should try them. California would be a good place. We'll watch and follow accordingly. Those "crazy" ones that prove really sensible, we'll get to them by and by. Meanwhile we aren't going to shoot the moon on any more of this nonsense . . . [new math, ungraded schools, new topical courses].*

An elementary school teacher who was trying to cover fifty years in a coffee break told me the thing I

> *. . . had to learn most about our schools is that change comes very slowly to River Acres. We had it good and knew it before all this started to happen. The old time Houston farmer made sure there were twelve good years of public school for his kids. Those who couldn't cut it didn't deserve to. They have always had a good college-bound curriculum. Then they sent their children to the best schools to get away from the dust, the oil and the cattle. That won't do anymore. Some may yearn for it but it just won't do. All kids need to get their chance.*

The administration of River Acres sees architectural change as providing opportunity for more children "to get their chance." But open-space education, now a few years old in River Acres, came from the "top down" and is embraced by few of the junior high and nearly none of the senior high school faculty. For the detractor it represents how change occurs.

> *If you want to see where Texas is going in education, check where California was five years ago. We just follow, we don't learn. We have California's open schools of the 1960s, with one problem--the concept crashed in flight coming over the coastal chain. We ended up with closed education in open architecture.*

In the River Acres School District I found an easy-going administrative style that accompanied the helter-skelter day-to-day problems of rampant growth. The citizens by their absence at school board meetings are saying "things are all right." Simultaneously, a group within the district is working toward municipal secession from the district, a maneuver encouraged by Texas law. The easy-going administrative style masks an informed concern. They are aware of what is going on behind the scenes. One parent said the superintendent had more news sources than Deep Throat.

Others feel the administration is caught in a responsive rather than a leadership mode. They assert that the pace of change in River Acres is more than it can handle. "Who could handle it?" I asked. "A young, sensitive Texan who could make us proud of what we are--and who ate hurricanes for breakfast."

One of the storms that reoccurs regularly for the administration is the practice of grouping. How many levels; what criteria to use; and what are its effects? The conventional representations are made. There are calls for more instructional levels, for as many as seven in each grade in each subject. There is a top administrator who wants fewer instructional levels, "two would be about right."

The profound humanistic issues that lie at the heart of grouping were revealed in a discourse by a junior high school teacher.

> *I have taught in a system that tracked from kindergarten on up. When you get grouped in a small town it's like branding you with a letter on your forehead: "smart, medium, dumb." You've got to live in that community the rest of your life. If you were branded "dumb" when you were five years old you were going to be called "dumb" when you were fifty-five and you may have been the genius of the community. You have been labeled and you would be with that group of kids all the way--for as long as you stayed in school.*
>
> *It might be that you were just sick the test day, didn't hear well, saw things wrong, it could be that you are a late bloomer; there's all kinds of things. But once you track these kids there isn't any way to get them off the track and you can talk administrators until you're blue in the face and everyone of them will tell you, "Oh, we re-track, we re-track."*
>
> *Get a hold of the records on kids and you'll see that they are not re-tracked. In fact the one kid in ten, no, one in twenty-five, that gets re-tracked is so rare that everyone points to it as flexibility! If you tell a kid he's dumb in the first grade, he's dumb in the second grade, he's dumb in the third grade, I don't care how bright he is; he's figured it out, he's supposed to be dumb and he-will-be-dumb-in-school!*
>
> *I have taught the accelerated child from the first grade on and the ego problems are severe. They are told they are a whole lot smarter than they are. They have terrible relations with the other students often lagging behind in emotional common sense. Further on the kids hit high school and college and POW! It's quite a jolt to discover that they aren't the only smart people in the world. And when they don't make the top grade on that first calculus test they think the universe has folded because they've never made a C before. They have never been in a classroom where people make a C and don't jump off a desk to commit suicide--where you take it and sorta grin and bear it. They have missed a lot of learning from the C students along the way.*

The philosophical worrying of what schooling in River Acres is and shall be is a luxury not available to most of its administrators and teachers. They are busy building a new educational bicycle while they are riding it. Whatever is done in River Acres, it will not be characterized by the abandonment of coherence and order.

Ms. Helene shared a world view with me that went to the heart of the matter of education, schooling, parenting.

> *Schooling is fundamentally illusory as we practice it. Open space and traditional space fall into the same trap. Everybody runs around doing things for children, for students. After a short time even the dullest teacher starts to see that not much of anything he does makes much of a difference. It's what students do that makes the difference. Now what is a teacher to do? Keep up the illusion? Keep doing things and call it teaching. Give the kid this and then give the kid that. Nobody ever gave me anything worth anything until I didn't need it.*

River Acres teachers may not dazzle you with their pedagogy but the depth of their understanding of education cannot lightly be dismissed. A sense of purpose is what has been called into question by this last teacher, as it was by many others before her. Texas poet Quintana enhances our appreciation of Ms. Helene's view.

HEREDERA (heiress)

"when you grow up,"
my wife tells sandra
the oldest daughter
"you can have
all my indian jewelry."

immediately,
the proud heiress
of turquoise and coral
makes her first proclamation:

"and when you get little,
you can have all my crayons
and coloring books."

Leroy V. Quintana

A science teacher I was to interview missed her appointment, so I wandered the Central halls as I did on occasion. I had an hour and the muse led me to a poetry teacher seated at her desk during a free period. I told her what the study was about and she told me what River Acres was about.

> *Who are we? We are the sons and daughters of ne'er do well sons of the East who came West. We are Virginians who lost our graciousness, kept our goodness and increased our gumption.*
>
> *This time of year I miss the clan gathering, where we sit around and tell the stories of River Acres; where the religious concepts and work ethics seeped through every tale.*
>
> *We have a passel of old fashioned concepts that I very much admire. I have taught around the world and have returned home. A different home, a different person; but home. Some sophisticates would listen and call it corny. I call it good.*

I know the good she is talking about: some still do. Education professors have large, incomprehensible words to discuss educational issues such as those found in River Acres, Texas. These teachers rarely hid behind their words. They taught me the small words are the good words and the old words are best.

I left River Acres hoping it would be there when I return, knowing that it would not, and feeling that it would be better than it was. Like ice fishing, trying to explain it to somebody else is ridiculous.

Before assuming his current duties as Assistant Dean for Graduate Programs in the University of Illinois College of Education, Terry Denny held appointments as Evaluation Specialist and Professor of Education in the Center for Instructional Research and Curriculum Evaluation (CIRCE) and, later, in the Committee for Culture and Cognition at the University of Illinois. Such achievements are particularly impressive, he notes, for a person who was once blocked for promotion to Associate Professor at Purdue in 1963. He has taught in public and private institutions from first grade through graduate school in departments of psychology, elementary education, and educational psychology. By his own admission, his teaching has been "uniformly brilliant."

Among the highlights of his professional career, he includes working with Reginald A. Neuwien and George Shuster on the National Study of Catholic Education, 1963-64. (Terry directed the research department in that study.) He also served as the first research director for the nation's only independent, non-government consumers' union for educational materials, the Educational Products Information Exchange (EPIE).

In addition, he has conducted evaluations of ESEA Title III programs, learning centers in maximum security prisons, instructional television, and special education. Both the broad spectrum of his educational interests and his experience in the evaluation of teaching materials are reflected in his research and his writing, which includes publications in Catholic Education Review, The Reading Teacher, the Journal of Educational Measurement, Elementary School Journal, Educational Researcher, and Educational Product Report. He has also written working papers for CIRCE and co-authored (with Robert Stake) the chapter, "Needed Techniques and Instruments to Utilize More Fully the Potential of Evaluation," in the 1969 NSSE Yearbook on Educational Evaluation.

Born and raised in Detroit, Michigan, Terry received his Ed.D. from the University of Illinois in 1962. He and his wife, Phyllis, are the parents of four children and live in Urbana, Illinois. In response to a query about important details of his life, Terry volunteered that he is a Roman Catholic, an anarchist, and he speaks respectfully to Lithuanians.

Chapter 2

TEACHING AND SCIENCE EDUCATION IN FALL RIVER

Mary Lee Smith
Evaluation Research Services
Boulder, Colorado

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2

Fall River is a relatively small city on the high plains a few miles east of the Rocky Mountains. In recent years new industries have attracted a rapidly growing population of professionals, highly skilled technicians and industrial laborers. With these new residents have come new values and expectations. The nearby mountains with their potential for aesthetic, recreational and economic opportunities exert an ever present influence on values related to conservation and/or exploitations of natural resources.

As one might expect, these differing values are reflected in the expectations that various members of the community have for their schools. Often, administrators and teachers are placed in the middle of conflict about such issues as open space schools or accountability. The absence of power to resolve the conflict leads to tension and frustration.

In her case study, Mary Lee Smith has done a masterful job of portraying the prevalent issues and how they affect the various people associated with the Fall River School System. When I read the study I could very easily picture the places and people about which and about whom she was writing. With a sensitive and artful prose she has interwoven quotes of students, teachers, administrators and parents into a sometimes subtle but always insightful view of the total school scene.

Mary Lee Smith's concluding comments to her study deserve special attention. These same conclusions could have been drawn from any of the sites that I visited. Any national "movement" or program would be remiss not to take them into consideration.

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TEACHING AND SCIENCE EDUCATION IN FALL RIVER

Mary Lee Smith

The study of science education programs at a single site, Fall River, Colorado, exposes bits of the history of the field. In this archaeological dig can be found remnants of each era: the pre-Sputnik traditional disciplinary science--still used in some classes; the textbooks, equipment and institute-trained teachers left by the first two generations of National Science Foundation activity; the enrollment decline and disillusionment with science coincident with the romantic rebellion; the enrollment resurgence that has come with the new pragmatism; the recent popularization of the ecology movement. All of these historical eras have had effects at Fall River, and all left some relic. In each case the impact was deflected or diffused in some way, as if an alien culture had attacked an older one, entered its territory, but gradually lost its language and separate identity, absorbed into the older one.

People outside the schools have relatively simple ideas about how schools work: to change education in a desired direction (e.g., to get more physicists, more science-literate citizens, equal opportunity, better human relations), one must merely manipulate one or two variables (e.g., improve teacher training, write better textbooks, enforce rules, abolish rules, write behavioral objectives, enforce standards, remove walls, add walls). This site revealed once again that schools are complex social systems with histories, customs, values, enforced standards for performance, authority and status relationships. All affect the education which somehow happens to occur and frustrates efforts to change it.

IMPRESSIONS OF COMMUNITY AND SCHOOL

The subject of the study was Fall River High School and the elementary and junior high schools within its attendance area. All are located in the city of Fall River (population 36,000). Old Fall River was a self-contained community of 10,000 until the growth spurt of the 1960s. This core area remains, but is now surrounded by tracts of housing development. It is not uncommon to see two residential development tracts separated by a field of corn or a cow pasture.

Main Street divides the old Fall River into what the residents still believe are the more and less desirable halves. A quiet Hispanic community occupies part of the eastern section. Nowhere is there striking evidence of poverty or deliberate segregation. Although the older downtown and Main Street shopping areas still have an Old West look about them, farther out on Main Street one encounters all the features of a suburban strip such as might be seen anywhere, with shopping malls and "fast food" chains. The people who live in these newer areas are likely to commute to the metropolitan area or to the major electronics firm in the next town. They are only now beginning to make inroads to the social and political life of the community, of which old Fall River still has a disproportionate share. The ambiance is rural, conservative, religious.

The school construction program is said to be almost always behind the growth of the community, and Fall River High is chronically overcrowded. Five years ago a new high school was opened in the adjacent town. Students from the most prosperous of the new housing developments as well as most of the Hispanic community were sent there, leaving Fall River High dominated by old Fall River. Next year a third high school will open in the northeast corner of the city, now just cornfields.

The Board of the Fall River Valley School District governs these schools, plus others in several remote rural communities. The district stretches from the foothills of the Rockies, down the rich river valley, to far out east on the plains. The district maintains fifteen elementary schools, nine secondary schools and a career development school in the district, with a total enrollment of 15,000. The current enrollment growth rate is two percent per year, a rate much lower than that of ten years ago.

Observers of the community say that sentiment toward the school can be divided three ways. The majority of the community tends to be supportive, even proud of the schools. Members of this group are quiet unless aroused by an extreme situation, don't come often to the schools or participate on advisory committees, and so far have approved school bond referenda. But there is usually a light turn-out for school elections, and school officials are careful not to ask for very much. When people speak, they are concerned that education stress the basic skills and prepare the students for future work. Occasionally they talk of problems with the schools--too many administrators, lack of communication and trust, innovative gimmicks, too many special programs, not enough being done for the able student, not enough discipline. Old Fall River still views Fall River High School as the hub of the community, and many turn out for its musical and athletic events. The second group is small, vociferous, active, and have what the other groups perceive as disproportionate influence. These people seem to distrust professionals and worry about encroachments on local control of schools by federal and state government. Much energy is spent in all parts of the educational system to cope with this group. The third group is a cadre of parents and citizens who serve on the Accountability Advisory Committee and other study groups. They are the allies of the school people. They work hard and take their responsibilities seriously. They occasionally feel frustrated that the board of education fails to pay them much attention.

The board of education reflects sentiments of all three groups. Most board meeting time is spent in business matters. One departure from the usual activity was a decision to raise graduation requirements, a decision which reflected an apparent community concern that seniors had too much free time and took too few "solid" subjects. After the vote was taken, a board member contended that, regardless of the number of credits required, the students would still graduate without skills because they were allowed to take science fiction courses rather than required to learn how to write. The superintendent reminded her that the board's role was to set policy and the professional's role to determine what educational programs would satisfy it. Few people attend the board meetings--some of the concerned parent group, all of the school administrators, a handful of teachers there as watchdogs for the Fall River Educational Association.

The association is at that stage of development in which most of its attention is spent on issues of salary, security, and consolidation; relatively less on educational issues. Members are assertive but not militant. The relationship between the administration and the association seems almost paternalistic at times. The association, for example, readily accepted as authoritative the administrators' interpretation of the results of research on class size and dropped class size as a bargaining issue.

The administration of the district travels in an uneasy orbit held in place by the centripetal forces of attempted centralization of management and curriculum coordination and by the centrifugal forces of territoriality and building autonomy. Although the central administrators have attempted to organize the principals into a team to make decisions for the entire district, the image of the principal as Lord in His Domain remains strong. The central administrators strike one as conscientious and competent, although the cast of characters changes fairly often. One senses that they believe teachers ought to be managed rather than served.

One of the primary centralizing forces is the curriculum planning process, which involves stating district goals, detailing the district-wide curriculum in the form of behavioral objectives, implementing the resultant curriculum planning guides (the current stage), and evaluating. The process, given additional impetus by the state accountability legislation, has absorbed enormous amounts of time and energy of teachers, administrators, and advisory groups. The last group generally feels that the process was worthwhile and the product will play significant role in classroom instruction. Administrators are proud of the guides. Teachers' reactions are mixed. Some feel that the process was a good way to involve and communicate with the public or a good way to organize the curriculum. Others feel it was an empty exercise, a way to turn teachers into bureaucrats, or to decrease their prerogatives. No one effectively addresses the question of exactly how the guides make teachers more accountable or instruction more effective.

The major role in developing and implementing the guides belongs to the curriculum coordinators, for whom it is one of several duties. Mr. Johnson, the math-science coordinator, is occasionally resented by some of the teachers for "pushing" the planning process, though few doubt his effective advocacy of science education or his vigorous pursuit of district resources for math and sciences. For a variety of reasons, there is no one in the district playing Johnson's role for social studies programs.

FALL RIVER HIGH SCHOOL

Fall River High School impresses initially with its automobiles. Cars full of young people cruising around the school grounds and adjoining streets--older cars mostly, no sports cars betraying excess wealth; some have been rebuilt to move at a rakish angle or garishly painted in the style of the 1950s; many pick-up trucks. Kids sit in cars in the student parking lot, smoking, some talking on citizens' band radios, all delaying entry to the school building or waiting out free periods or getting ready to drive out to the "fast food" restaurants or the career development school for vocational courses.

Buses arrive and flocks of students emerge heading for the south hall. Near the door are clumps of students, smoking, somewhat isolated from the in-groups. Inside, a trophy case is a reminder of past athletic feats and present athletic aspirations. Hand-made posters exhort football, cross-country skiing, tennis, and girls' gymnastics teams to victory. Farther along the corridor are two distinct eating areas. In the first, students are reading, finishing homework assignments, and talking quietly. In the other, a dozen boys gather around two foosball tables while their cohorts talk loudly and indulge in mild horseplay. Groups of boys distinguished as athletes by dress and swagger line the walls, occasionally reaching out for or calling to a passing girl, and comment on the "talent." Three teachers supervise these areas--others are stationed around the building. They spend the time doing their own work, stopping only when the noise or horseplay exceeds a certain known but unspecified threshold.

Despite the presence of teachers, this is clearly student territory, where student roles are enacted and taught to initiates. The school world does not intrude. There is a feeling of regularity, of sameness, of ritual--almost as if one would see them doing, saying the same things, sorting themselves out in the same way five years in the past or future. So much happens, but the activity is without spontaneity or vitality. (This feeling is in marked contrast to the adult, purposeful, business-like atmosphere of the career development school.) The student world at Fall River High spills out of its assigned territory into the halls and library. The scheduling system they use, similar to that used in colleges, allows free hours between classes; the students who are free create noise enough to disrupt academic work in classes near the student areas. The public complains about the amount of freedom allowed by the scheduling system. Yet the system represents, not the 1960s philosophy of freedom, but the necessity of cramming 1,800 students into classroom space meant for 1,400.

The library, well stocked and staffed, fulfills its traditional functions for only about one-third of the students there at any one time. Always crowded, it is the crossroads for all the identifiable cliques in the system. One table seems to be reserved for the athletes, and another, within hailing distance, for the "blue-uniformed girls"--the cheerleaders and pompom girls. Other tables are filled with kids talking about their jobs (many students have them). The intellectuals/student leaders (two interlocking categories) rush in and out, conducting the business of student government or working for the campaigns of political candidates or preparing for debate meets. "Tight" couples cuddle at corner tables. The "cowboys" don't often come in. A few people work seriously, although the noise and movement play havoc with concentration. Not much work gets done, here or elsewhere, in the view of many of the students themselves and several faculty. One of the students reported:

> *. . . Kids here have the feeling that high school should be fun, the happiest time of your life, like on "Happy Days" or "American Graffiti" . . . so they do about the minimum necessary to get by and get out. . . . A lot of them are just hanging out, you know, it's the place to be with your friends and see people.*

The teachers have their own social group and their own territory--the lounge. Few teachers have sole access to a particular classroom, contributing to a nomadic feeling and necessary use of the lounge. It is a sanctuary and site for traditional ceremonies. It is a shabby room; yellow cinder-block walls and dilapidated stuffed furniture surround the lunch tables. A room divider shields the room from student view. There is a rack of professional journals and a bulletin board for professional association notices, ribald cartoons, schedules, etc.

At any hour there are at least a half dozen teachers there, relaxing during their preparation period (that euphemism!), eating lunch, spending time before and after their work day, and some shaving time from their hall duty assignments. The conversation is banter, joshing, and sports. No athletic team escapes expert analysis. The merits of particular football defensive strategies are debated, the physical gifts of athletes judged, and the prospects for the next season contemplated. When the coach himself comes in, the company offers him their pet plays. Bets are made and discussed.

All this leaves little time for discussion of other matters; but matters of insurance, course loads, salary scale, pensions, have some share of the talk. Occasionally the talk is about administrators--not the ones in the building, generally respected and considered part of the group--but the ones "downtown." The tone is usually negative. One gets the feeling that "We" and "They" are not playing on the same team.

> *There are guys down there that don't even have a job description. They run around trying to do things to justify their jobs.*
>
> *Administrators ought to have to teach one class a year just to keep in touch with reality. They get down in that central office and forget what it's really like. Education professors should have to do the same.*

There is a little talk about students, how they've changed, how they can no longer be made to work, how they don't care as much now. In general, though, the teachers don't talk about professional matters, how to improve their teaching or their subject matter knowledge, or of ever ("God forbid") ascending to an administrative position. There is that same feeling of regularity and sameness, as if the lounge patterns were laid down years ago. It's a comfortable, friendly place for those who fall into the patterns. Not all the teachers do. Some deliberately avoid the lounge and don't share the interests and values of those who abide there. If a department has a headquarters, there is opportunity for other sub-groups to form and pursue their interests. One of these is the math-science room, crowded with desks, supplies, and equipment. The teachers use the quiet to study, prepare for their courses, and exchange ideas and feelings about teaching.

The academic life at the high school (speaking only for science, math, and social studies) appears to be confined to the classroom. Even there, academic business is in almost constant danger of being overwhelmed by the student society. What takes place in the classroom is the province of the individual teacher. The building administrators occasionally observe and evaluate, but teachers rarely intrude on one another. If a teacher chooses to lecture, run discussion groups, or confine himself to showing films, an unwritten rule seems to hold that others will say nothing about it. Curriculum--the coverage of a single course or the relationships among courses--is discussed and agreed upon in informal department meetings. Incursion into this system by central administrators or committees is likely to be resented, sabotaged, or passively "waited out."

The students appear to accept the primacy and authority of the teacher, for the hour they sit there. There is rarely an outburst in class; one never sees the student flouting the authority of the teacher. Truancy is the only serious discipline problem in the school. Classroom problems that exist are problems of acquiescence and passive non-involvement. Many teachers express concern about conducting discussions. It is difficult for the observer to pick out the best students in any class. They are as quiet as the others. They don't seem to provide that spark that can help a teacher strike a lively pace and maintain a taut intellectual tone.

The academic life in a classroom is maintained only so long as student attention is directed at some specific activity--a lecture or problem to be done on the spot. When this condition is not met (e.g., when class time is made available for student study), students relax at once; attention is directed immediately to each other. Social processes are so much more compelling than school business. Work can always be postponed until those lonely hours at home; during class there are more important things on students' minds than bookwork.

> [*Observation of an advanced science class.*] *The teacher had assured me that he would start a new unit today, but the students had performed poorly on the unit test and he had agreed to review and retest them. During the review the students quietly and diligently took notes. Then he asked for individual students to approach him with problems while the others reviewed their tests. Immediately what had just been one class broke into several conversation groups. The noise increased. One student went back to the lab to perform an experiment he had missed. The banter started with usual game of "wha'ja get?" but talk about science was soon replaced with talk of girls, dates, cars, the latest track meet, the injuries suffered in Friday's game. Although the teacher tried to bring the class back to science, the hour was lost. Two girls from the hall opened the door and beckoned to a boy to leave class early. Several students sat staring, waiting for the hour to be over.*

The High School Science Program

The high school science program consists of eighteen courses. Despite lenient graduation requirements, enrollments are high. The courses are staffed with an impressive group of teachers, most of whom have advanced degrees in the disciplines and have attended National Science Foundation institutes.

The biology program has the largest enrollment and staff. All students who elect biology take a one-semester introductory course, after which they can choose one or more follow-up courses in ecology, plant structure and function, social biology, microbiology, heredity, and animal anatomy. Some students fail or opt out of biology after the introductory course. An advanced placement course in biology is also offered.

The content of the introductory course is largely the same regardless of who teaches it. The text used is from the Biological Sciences Curriculum Study (green version). The instructional methods are largely lectures, lab investigations, review sheets, and occasionally films and guest speakers. Although the BSCS text emphasizes developing students' interest and heuristic inquiry, the classroom instruction at Fall River High tends to be formal, didactic, and organized. Almost the entire text is covered. This is a large quantity of material for one semester, but it provides the background needed for the more specialized follow-up courses. In the ecology course, for example, the students review the relevant BSCS chapters and then go on to more specialized texts. They participate in simulations designed to show the relationship between values and environmental processes. Topics covered include ecology and the law, mountain eco-systems, and the food chain. Laboratory investigations on photosynthesis and chromatography are conducted, as are field investigations in small eco-systems near the school building. The students conduct independent research on biomes.

Although the other follow-up courses are not so directly related to the environment, a strong environmental consciousness pervades the entire department and has been adopted by many of the students who participate in Earth Club. When asked about the principles that underlie the program, three teachers made the following statements:

> *[The purpose is] to make them better citizens, help them understand the issues in society that are related to science, help them make better decisions. Like I ask them how much longer they're going to be able to drive up and down Main Street. I don't try to impose my own view on them, but I do try to make them think.*
>
> *You can't separate out values and science anymore. When we talk about population growth or genetics, controversial issues come in. I tell them they should learn the material, if only so they can determine their own futures.*
>
> *The person just can't be an effective citizen unless he can read and understand political issues that have scientific overtones. . . . The average citizen has to have the awareness and appreciation of how his actions affect the environment and what is likely to happen depending on the choices he makes now.*

In addition to the notion of developing environmental consciousness, the teachers believe their purpose is to provide a strong and diverse academic experience that puts the students in touch with the major body of knowledge in biology and the processes used to arrive at it. One teacher reported, "Any systematized body of knowledge is part of the foundation of civilization. It's part of their responsibilities as citizens to be aware of it. Science has applications in all their lives."

The biology program is not without its rough edges. Students in the introductory course fail in higher proportions than other courses. Most teachers are determined to hold to their standards, however. Based on previous experience, they are convinced that students will take the easiest possible path and dilute the content of the course and make the follow-up course structure impossible. The teachers feel that any student who makes the effort can pass.

Another serious problem is lack of space and facilities. There are two well-equipped laboratories, but sometimes four sections must share them in a single class period. Therefore, the teachers have to coordinate classes so that while one section is doing lab work, the other teacher must lecture in the classroom designed for physics. No space is available for advanced lab preparations. They look back wistfully on the year they had a teacher aide.

> *Not having the facilities lowers my interest and energy and influences what I teach. The situation has discouraged every bit of open-ended inquiry I've got. A question comes up from the class and I think of an investigation that would be related, but there we are in the physics room, so I lecture.*

About forty percent of each graduating class go to college. A greater proportion of students follow a traditional college-preparatory course of study. Most of this group take chemistry in the junior year. The chemistry classes are packed, but it is unclear whether the high enrollment is due to students' scientific curiosity, the genial personality and showmanship of the teacher, or the abundance of A grades. Although there was some complaint from the best students that the class "wasn't tough enough . . . didn't go too deep into chemistry," the instructor primarily wants

> *them to be interested in science and to master the basic material in the field. I feel like anybody can learn at the level I teach them. The kids who are really interested then can go off on their own and learn more.*

The text Modern Chemistry is used, but the approach is traditional. The vast majority of class time is spent in lectures and laboratory experiments. The lab areas are well equipped for a basic program, but the teacher longs for materials that would support more advanced work. The labs are terribly overcrowded and the teacher worries that someone will be injured in an accident.

The physics course is taught by a man with experience and impressive credentials--advanced degree in physics and math, several NSF training institutes including training in the use of both Physical Science Curriculum Study (PSSC) and Harvard Project Physics (HPP). His lab is well-equipped and under his leadership the science program has always received a healthy share of the school budget. He now uses HPP in his three sections of physics. For several years PSSC was used but "NSF backed a real loser with that one." He found that few students were capable of learning the PSSC materials, enrollment dropped, and the physics program was jeopardized. He decided to change over to the HPP course and textbook, somewhat less theoretically and mathematically rigorous and appealing to larger segments of the school population. A few students and parents complained. One parent stated:

> *I've been very disappointed with the district for watering down the courses. There used to be a really strong physics program* [*under PSSC*] *but then* [*the teacher*] *decided he needed to accommodate the low to middle achiever so he threw out the good program and came up with this other one that is less comprehensive. It really hurt the well-motivated kids.*

In answering a question about the purpose of science education, the physics teacher spoke of his own philosophy:

> *In recent years I've wondered if you could justify it. Earlier I would have said that physics was a part of cultural knowledge, something enormously practical, like all sciences having something philosophically to offer the public, an intellectual integrity which could carry over into politics and society.*
>
> *Now I don't know. We live in a technological society so it is necessary to propagate information to some parts of the society. But for the general person in high school who will eventually go into business or become a*

homemaker, they really don't need to know about physics, except in a very superficial way. If you want a kid to know how to change a tire, you teach him about levers . . . I'm a good sailor and I apply my knowledge of physics, but other people are better sailors and have no physics background.

That is too pessimistic. Let me state it this way. Everyone deals with nature. Every high school student knows a great deal of physics and the teacher merely encourages him to abstract his knowledge to form more general and sometimes more useful patterns of thought. If the student can deal with ideas in the abstract, he learns this before going to college and can thereby make a sounder choice of careers. He may not do better than another competent college student, but he has had the benefit of guidance and proven academic discipline. Finally, and this is important for all ability ranges of students, a sense of being at home in the universe must be transmitted. The physical world and the technology of man must be dealt with as an important part of the total culture he is to inherit.

My greatest contribution is to get students to grow intellectually as much as possible. If a kid doesn't appreciate a subtlety of physics it doesn't bother me. I'd like to bring each kid as far as he can go. What I'm definitely not doing, but used to do, is to prepare Ph.D. physicists. I was looking for that occasional student--but he only comes around about every four years, and running the class at that level . . . that's no longer how I want to work.

I don't think that this [less rigor] hurts the college-bound. From the statistics I've seen it makes no difference in college freshman physics whether the person has had physics in high school or not. How he does in college is more dependent on his intelligence and motivation rather than his high school preparation . . .

I now expect less of the kids than I formerly did. This is true of almost all teachers. Now I pay more attention to the kids--to relate to the kids on an emotional level . . .

[On the absence of science clubs and science fair activity] It's the general wind-down of interest in the sciences, after we got out of the competition with the Russians after Sputnik. Much of the interest in science was really interest in competitions. Kids did become aware of science and interested in learning about it, but the principal reason was to catch up with the Russians. Much of the science fair activities were generated for the competition aspects more than pure science. . . . The student who can do research is a relative rarity. . . . Research is a terribly frustrating activity very unlike the experiences that students have. . . . If you form a science club, most of the interest is generated over who is going to be president. Once they get the officers elected, they're ready to go out for pizza. So the kind of interested students you would like to think are there, just aren't. . . . You don't see much intellectual curiosity or discipline. That's just the way it is, and there's no point in trying to make researchers out of ordinary students. . . .

In addition to the more traditional track of three courses, the science program includes a great variety of offerings: astronomy, archaeology, geology, conceptual physics, electronics (less mathematical than the physics course), introduction to chemistry (a student-centered, laboratory program using discovery techniques and emphasizing the process of science) and space science (a rather easy course for students who have a previous failure or little interest in science).

The man responsible for several of these courses is a former geologist who runs his classes very informally, trying to structure each one around the interests and questions of the students. Environmental consciousness appears strongly in his courses as well. In the course description for geology he wrote:

> *Our study of geology will be centered around the following concepts: Geology, the study of the earth, is essentially an environmental science. . . . Man . . . must learn to function in harmony with the earth environment. . . . Citizen roles dictate an understanding of the environmental problems confronting man, solutions to these problems, and the responsibilities of citizens and government to work toward their solutions.*

These objectives are not mere educational cant. During his classes, this philosophy is never far off, injected even into a presentation on the physical properties of minerals.

In his courses perhaps more than those of others, scientific methods are given prominent attention. In the archaeology class he listed the following among his objectives.

> *Demonstrate an understanding of the process of identifying and defining a scientific problem or question to be investigated . . . of proposing a logical test of a hypothesis . . . of testing the effects of variables and controlling relevant variables . . . the ability to synthesize data from several sources to arrive at generalizations or conclusions . . . withhold judgments or conclusions until adequate information has been validated.*

In interviews he spoke of his frustration (shared by several other teachers) with both students and the district administration:

> *I have also had to modify my practices for kids that can't assimilate material from lectures and films. When you have such a large range of student abilities it becomes difficult to come up with a satisfactory compromise. I've had students who were five to six years behind in reading ability. This shows up not just in their ability to read but in their ability to sit in class and listen and understand. . . . We're just trying to come to grips with the student who isn't interested in science and we have quite a number of them. This is hard for us because we have always been interested in science. In the past even if you weren't interested in science you knew you had to take it because it was important. Now the public is questioning the value of science, for some good reasons. Sometimes it has appeared that science has been misused. People are upset with the high costs of science, particularly the space program. What they don't realize is that this enjoyable society has been brought about by basic research. . . . I spend a lot of time in class explaining the benefits of doing basic science. Like last year when the Senate was upset by the studies that were trying to figure out why people fall in love. That may seem silly but perhaps the results of that might help us solve our social problems. . . .*
>
> *I've had a lot of spark taken out of me in the last two years. We hear [central] administrators talking about meeting the needs of students--individualization. But we never get time off to develop these things or the financial support. We don't get the help we need from counselors, in terms of placing kids in the right science courses. I've talked to them [central administrators] about getting materials and they say that materials aren't as important as the student-teacher relationship. But I find it very difficult to stand up and play Johnny Carson everyday. The kids don't want to hear lectures, they want to do things. . . .*
>
> *I always thought that the main goal of education was teaching kids, now I find out that the main goal is management. We want more money, so does every other department in the school. I have some opinions about the amount of money they spend on athletics. I'm biased. I'm in the minority. . . .*

> *Some teachers are no longer interested because of frustration. You can try and try, but you never get any recognition or monetary reward for your efforts. It doesn't gain anything to innovate or analyze or revise or evaluate.*

There seems to be a gap between teaching and learning in the science program at Fall River. The teachers are interested in students and extremely well-prepared in the sciences. The curriculum is strong. Instruction is effective. Yet the students are not very involved in study. One teacher responded to a request for the names of the serious science students by asking, "What serious science students?" Independent study, research, free time participation in scientific activities are rarities. One of the highest achieving seniors explained her motives for taking an advanced science course as "a way to get some college credits out of the way."

One teacher accounted for the discrepancy this way: "We lack the element in the community that knows what gets people to the top and keeps them there. These are the people who put pressure on their kids to excel in science, and interfere constantly to make sure the school is providing the best, most rigorous education."

The High School Mathematics Program

The math teachers are proud of their program. They have a sense of purpose--to provide each student with as much math as he is able to learn. Students follow three tracks. The most difficult consists of geometry (first-year algebra having been taken in ninth grade), a second-year algebra plus trigonometry course, math analysis and an advanced placement calculus class. The second track is for students who move more slowly or find out later that they want math courses: Algebra I, informal geometry (with less stress on formal proofs), a year-long Algebra II course, separate trigonometry and math topics courses. Students who haven't passed a math course may wait a year and take a business math course. Personal finance and computer math are also offered; but for the latter, students must be bussed across town to Stockman High. A seminar is offered for advanced math and science seniors.

What strikes the observer is the uniformity of philosophy and methods among the teachers in the department. Except for two younger teachers they have all worked together for many years, are comfortable with one another, make curriculum decisions easily, informally, consensually. The scope of geometry is determined by the knowledge and skills needed to begin in Algebra II-trigonometry, which in turn prepares students for math analysis. Most of the students who follow the sequence to the end pass the advanced placement examination that follows the calculus course.

The classroom processes are remarkably similar among courses and teachers. The following is a description of a geometry class visited several times.

> *This is a light, pleasant room with seats in straight rows and students at attention. The opening classroom housekeeping is fairly business-like, but there is warmth and humor exchanged between Mr. Bennett and the pupils. He asks one of the girls how her track meet went. Mr. Bennett is a veteran in math education, yet he still loves to teach geometry because it is a tough subject and he enjoys helping the kids struggle and finally grasp it. Students speak fondly of him yet respect his toughness. He begins as he usually does, with a general introduction to the topic (today it is mathematical induction), giving some common sense examples, then turns immediately to the problem assignment for the day. He calls on students to give their answer to the assigned problems. Then he asks which problems caused particular difficulty. He goes over the tough problems step-by-step on the chalk board (sometimes*

he uses the overhead projector). The emphasis seems to be to try and find the step in the problem at which the student got on the wrong track and correcting him with the proper algorithm. The next assignment is then given and class time allotted to work on it. As a student runs into difficulty he approaches Mr. Bennett, who tries to diagnose the difficulty: tracing the student's process down to the fatal turn, correcting him, and reminding him of the principle or procedure. Productive work on the assignment is expected and deviations rapidly corrected. Silly questions receive abrupt answers. He ends class with the admonition to do the assignment. "If you need help, you can always catch me after class or call me at home tonight."

In all the math courses the approach is didactic. The pace is relentless: they must go a certain distance in a fixed amount of time. Most of the teaching takes place between the student and the problems in the text (the textbooks consist of the Dolciani Series of Houghton-Mifflin), mediated more or less by the teacher. The "more" is characterized by the advanced mathematics teacher who runs his course in the following way. He asks for a troublesome problem from the daily assignment, having the students trace the steps they took, at each step asking "How do we know that?" and getting the relevant postulate or definition. When they have gone as far as they can go and reached that critical junction, he asks them to give a possible next step; then follows that up to see where it will lead, identifying the fallacy in the process; then backs up again for another suggestion, until someone makes the right one.

In interviews the math teachers expressed confidence in their program.

> *We offer excellent training for the college-bound. The non-college-bound student never knows when a particular trade requires mathematical training. For both groups we offer the discipline that comes from a rigorous regime of study.*
>
> *The study of mathematics takes levels of maturity. You have to take step one before you can take step two. There is a definite hierarchy of material. You can't hope to be creative until you've mastered the basic program of studies.*
>
> *We've found that traditional methods work. This is the way it was taught to us in high school and the way it was taught in college and the way it works for us. The real changes have occurred in mathematics itself, not in the teaching of math. . . . I don't think kids can handle inquiry. They can't by themselves put ideas together and get the concepts. They just don't have the background or sophistication. They would just take the opportunity to play rather than work independently.*

High School Social Studies Program

The social studies curriculum at Fall River High School is comprised of four government courses, two in sociology, six in American history, five in world history, five in geography, and one each in religion and philosophy. The program has no underlying and unifying principle. Much more than in the other two programs, each teacher has his own ideas about what should be covered in his course and how it should be taught. The important issues that concern the field of social studies education--the teaching of values in social studies, the use of social science methods in social studies, or the humanistic, self-discovery focus in social studies--are interpreted differently by each teacher. Such diversity resists description. But perhaps the following hypothetical trip down the hall will provide the flavor of the department.

The first classroom in the hall is subject to an auditory harassment from the cruising hotrods on the street. The noise fails to overpower the stentorian voice of the teacher of Civil War America, however, or divert the rapt attention of the students. He is lecturing while also pacing the classroom, calling on students with questions about previous material. Teacher and pupils are serious. The subject matter is history, yet the content is studded with frequent mention of social science concepts. He explains the terms and their bearing on the historical period--supply and demand, scarcity, market, inflation, political spectrum, political parties, social stratification. Then he gives the students a quiz and shows a movie on causes of that war.

Next door is a class on ancient civilizations. The teacher is standing at a podium, gazing into the middle distance, and lecturing on Mesopotamia. He uses the story-telling approach to teaching history, full of place names, dates, major causes, principal results; and dry as dust. The students take notes for the most part or fill in work sheets or stare into the opposite middle distance.

In the next room a well-qualified man with experience on the city council teaches a class in government. The content of the course is solid and should be engaging attention, but the students are not appreciative. He is lecturing about the relationships of government and the economy. "Some people say that the government plays too big a role in the economy. How many of you think it is now too much? [Two hands are raised.] How many think it is too little? [One hand is raised.] Well, Marty, you must not have heard the question."

"I heard the question. I just don't care."

In the geography class down the hall the High School Geography Project is being used. The students are working with stereoscopes on stereograms of New Orleans, searching for indicators of land use and answering questions about the significance of the river in cultural and economic life.

There is a film about an Amish colony playing in the next room, a sociology class. The content of the course is quite similar to a first-year college course, and the teacher stresses individual research and field work.

In the psychology class the atmosphere is different. The students and teacher are talking about themselves, their characteristics and problems. He is relating to them a four-part structure for understanding personality--four combinations of what one knows and does not know about oneself and what others do and do not know about one. Each pupil is making a list of things he or she is, and classifying them into the four-part structures. Students aren't forced to reveal things about themselves; most want to learn something about themselves. Other course topics are transactional analysis and Maslow's need hierarchy, as well as several areas of academic psychology. (In an interview this teacher related the purpose for his course: "The kids need basic understanding concerning behavior, adjustment, about how people deal with frustrations and conflicts. . . . They want to be understood, just as people. This involves discussion, especially acceptance. . . . Nowhere else in school can they get this acceptance. No one else treats them as whole persons.")

Current events are regularly discussed in the history and government classes. In the American history class the teacher is reviewing the papers on current events turned in the previous week. He speaks energetically:

> *I'm glad to see you people are really thinking about these issues. Some of you chose to talk about women's lib. Equal pay for equal work is okay, but we all know that if the woman works, that means that somebody else has got*

> *to take care of the kids, and that means day care centers and then we've got the government controlling the development of our kids, and then what happens to the family?*

The students listen intently.

Later the teacher expressed his opinion about the place of values in the teaching of social studies:

> *Values are important to a society. Without value and moral structure, countries fall. . . . You worry about the crazy teacher that doesn't believe in the norms of our society, that they will confuse the kids and tear the system down. Teachers are an extension of the parent and as such should teach the value system that is consistent with the community. The community has a vested interest in the schools and has a right to demand that certain values should be taught and certain others not be taught. . . . Every year I live and teach my values become more solidified. What I believe in I believe in. I know I come across strong. That worries me to some extent, because I realize the impact teachers have on kids. You can hear them going down the hall mouthing the things you just said in class.*

The most spirited class observed in the social studies department is philosophy, taught jointly by a pair of teachers. The content of the course--a review of major philosophical systems and examination of personal philosophies--is really less important than the students' involvement in the class. Their contributions are hesitant, halting, unpracticed but nonetheless authentic; undeniably present here while absent in other classes.

One of the teachers, who is the guiding influence for the course, gave his rationale for social studies. His philosophy was expressed in everything he did.

> *Social studies should help a student to become an effective competent human being, comfortable with living, able to cope with life and change. . . . [The way to translate this into the classroom is] for me to live it--for them to see me adapting to situations, being a model, with dignity, treating others with dignity, recognizing feelings both good and bad. But dealing with them as human beings, by itself, is not enough. There must be the element of learning. That is why they are there. If you just focused on what they wanted to learn and left it up to them, there would just be confusion and frustration. Their self-esteem would suffer because they hadn't done anything or learned anything. But if you can give them material and guide them to the point where they master it by some activity on their part, the experience success, they know they've accomplished something important and they really feel good about themselves. So the material is a vehicle for achieving that human relationship and that joy that can come from teaching and learning.*

The same teacher characterized the principal and his assistants:

> *They give us excellent support for our programs. I never have the feeling that they're looking down on us. Instead they're looking up to us and saying "What can we do to help your teaching be more effective?" I view the administrator's role as making it possible for me to be in that classroom without having to worry about administrative details, papers and pencils.*

The principal is viewed as young, dynamic, intellectual. He works with the social system that makes up the high school without being preempted by it or fully assimilated into it.

THE JUNIOR HIGH SCHOOLS

Two junior high schools serve the students who eventually attend Fall River High School. East and West Junior High Schools have the same general curriculum, but otherwise could not be more different. West has self-contained classrooms with an atmosphere to match. Though certainly not a martinet, the principal runs a tight ship with clear expectations for order and quiet. With some exceptions, the teachers work independently. Perhaps by coincidence, the educational philosophies of the teachers reflect the physical characteristics. Several spoke of the need that students of this age have for structure and organization and freedom from distractions. "We do kids a disservice when we let them pick what they want to learn or leave them free to manage their own time. They just aren't ready yet." As a consequence, there is heavy use of instructional objectives, structured learning activities with memory work, preprogrammed lab exercises and achievement monitoring.

East Junior High is an open space school, noisy, casual, buzzing with activity, often vilified (quiet unfairly) as a zoo, having more discipline problems than West and greater ethnic and socioeconomic variety among its students. Perhaps because of the open space, the instructional processes are more varied.

There are identifiable social structures at both schools, differing from each other and from the high school. Neither junior high is very old. Students and staff have shifted among the schools a bit, so that tradition and custom have less effect than at the high school. The student culture is less well developed. The behavior of the seventh graders is largely determined by adults, the parent-authority relationships carried over from elementary school. As the students get older they start to discover that their interests have less and less to do with those of the teachers, that it is the other children who can pass out more immediate and personal rewards and sanctions. By the ninth grade the students have been sorted into subgroups with varying identities possessing varying degrees of attractiveness and varying access to reward and recognition. By that age they have determined that practicing the group rituals and interacting with their friends is just as much a function of school as whatever the teachers are expecting of them. By the ninth grade, the worship of the body has become, perhaps, the main function of school.

East Junior High Science Program[1]

To the newcomer, the science area may be even too stimulating. The first time one walks in he is almost shocked by sights, sounds, and motion. There can be as many as six teachers and 150 pupils in a space about the size of six classrooms. When everyone is there doing science activities, the din is overwhelming. But when the teachers have preparation periods or students are doing work at their seats, there is less interference among the groups and a pupil in one area can easily filter out the noise coming from the other areas. Four-foot partitions, movable chalkboards, and screens divide the room into three sections: life science (seventh grade), earth science (eighth grade), and physical science (ninth grade). In one corner is an individual research area where students can go when they finish their work, and "Check Point Charlie" where a teacher aide and a student aide help manage the individualized program.

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[1] Except for a few digressions, the description of junior high programs will be about East. This choice was not made because one school was better than the other, but rather because of the space limitations of this paper and the personal inclination of the author.

> [*Observation of life science*] *In the life science area, some of the students work on an individualized program and the others have more of a structured classroom, working as a group under the direction of a teacher. The latter group is studying the protists. Because of the limited number of microscopes, the teacher has subdivided the students. Half are working with textbooks and worksheets, looking up definitions of vocabulary words (bacteria, algae, etc.) and writing down the characteristics of several simple protists. Several different textbooks are required to answer the questions, so the students have to use their initiative and not just copy the material. The teacher keeps them going at a fast pace. The other students are looking at slides prepared from beakers of water with different materials (wheat, hay, beans). They have a worksheet which requires them to draw what the microorganisms look like and to name them using the pictures in the text. The teacher moves around adjusting the microscopes and asking questions about what they're doing. At one point he says "Today we'll just be observing and recording. Later we'll make some guesses about what we've seen." After some initial frustration, the children finally spot the little creatures and then run from station to station excitedly comparing catches.*
>
> *On the other side of the screen, a teacher is orienting and coordinating individual work on what are called TREKS, the current topic being classification. Having had an initial TREK on how the system operates, the pupils start to work on their own, pulling work sheets for the objective they are currently working on, choosing the right textbook (several text series are used), or approaching Check Point Charlie for materials and supplies. The objectives for this TREK include learning how to construct a classification scheme, why organisms are classified, the basics for classification, the order of the major categories, the significance of the Latin scientific names, the three kingdoms and the characteristics that distinguish them, the number of phyla in each kingdom, how certain plants and animals fit in the scheme. Specific learning activities are keyed to each objective. Small lectures and filmstrips are introduced. Extra-credit options are also available. The students test themselves to see if they know the material. When they are ready, they get their post-lesson tests from the aide. When they pass they have appointments with the teacher who asks them thought-provoking questions to supplement their objectives tests. The pupils work hard and enjoy the TREKS.*

The life science course covers many of the traditional topics in biology. Here as in the high school, the environmental consciousness is apparent. The two teachers have helped develop a nature study area by the river and have written science lessons that take place there. They involve their best students in writing lessons for elementary school children and leading groups through the area. These teachers believe their purpose is to "get the kids interested in science" and to have the students experience as much science as possible.

The earth science classes are organized in the same way, with the students who can work independently working on TREK activities and the others covering about the same material, but as a group under a teacher's direction. The units covered are chosen from astronomy, meteorology, geology, and oceanography. Material for the unit on galaxies and the universe had been collected and organized by the two teachers from the scientific and popular literature and from slide tape presentations developed especially for this class. The objectives included defining the observable and unobservable universe; defining galaxies; knowing the different kinds of galaxies and classifying pictures of them by shape; knowing the name, shape, location, size and number of stars in our own galaxy; defining clusters and groupings of galaxies; locating the planet Earth in the universe; and explaining the Doppler effect, the Big Bang and Steady State theories. The teachers view these topics as necessary background for the topics which genuinely interest the pupils, such as black holes in space and UFO's. For the latter topic a slide of men landing on shore in a rubber raft was projected onto the screen for a minute. After it was shut off the students were asked to list everything they could remember about the picture. What was produced was an assortment of actual and fanciful items. The teachers used this exercise to show how different phenomena can be interpreted as "flying saucers" when viewed briefly in times of stress. They then presented six cases of UFO sightings--what the people reported, what the environmental circumstances were, and finally the explanation for the sighting.

Another exercise was the writing of a science-fiction story starting with one of six story lines (e.g., "You are part of an expedition of light-sensitive creatures from the planet Riegel 6. You crash on a planet that has no night. What happens?"). Still another lesson involved the "Message from Mankind" which was sent with Pioneer 10. A bulletin board contained a replica of the message and the students were asked to decode it. They discussed radiowaves and were given a message in binary code to decipher. In all these activities there was plenty of good science and plenty of student interest.

The teachers, Mr. Carlson and Mrs. Wright, have worked together to develop the program and write the TREKS. According to Mrs. Wright:

> *We needed some way of working with kids individually--to let them have a chance to learn how to learn. . . . We got some static from the science coordinator and the principal when we first started writing the TREKS. There was a lot of pressure. We had to prove ourselves. . . .*
>
> *We write all the TREKS ourselves. We borrow some things. Mr. Carlson used to be a geologist and has a ten-year accumulation of rocks and fossils and slides. He has forced me to go back and do a lot of research. [In some of the topics] my background is weak, but working with him has helped me make it stronger. . . . It takes a lot of pressure off you to team, because you've got somebody else to bounce ideas off of and somebody to interact with. . . . But the writing time is just overwhelming. We spend one month each summer and get together to write for three hours per day. We don't get paid for it. . . . We buy a lot of things ourselves. Stan recycles about ten percent of his salary into materials and equipment.*
>
> *Sometimes we overwhelm them with content. We also try to expose them to where science is going, what kinds of problems science is trying to solve. We go right to the fringe of knowledge and speculate about what scientists will think in the year 2000 about life in the universe or continental drift or whatever. The students' favorite things are on the frontiers of science. What we try to do in class is to get them ready to learn those few speculative-type things. They couldn't learn about black holes without going through the whole astronomy unit. The interesting things you have to prepare them for.*

These two pairs of teachers have evolved special relationships. The four meet each week to talk about science and teaching and other things that matter to them. They expect a certain amount of planning, writing, and revising of each other. They give each other support. It is a rare phenomenon in this district--perhaps anywhere.

Most ninth-grade pupils at East take the physical science course, although it is not required (everyone must take either math or science). The course is taught by Mr. Taylor and Mrs. Jones; the latter divides her time with the math department. They work in close quarters, but do not work as a team. When one is conducting a lecture and the other a lab investigation, there is interference, sometimes disruption. Mr. Taylor is young and independent, with definite ideas about how the course should be taught. Like the rest of the science department he resists using a single text, preferring to piece together units from a variety of kits and published materials with activities he has developed. He stresses building scientific skills, with lessons and activities to teach the metric system, scientific measurements, the scientific method, and lab procedures. Building on these skills, he moves through the introduction of chemistry and physics. He characterizes his approach as "hands-on, activity-oriented" but also presents a great deal of science content. He opened a unit on light by asking the students to copy the material that was on the overhead projector into their notebooks. It was an explanation of wave length and amplitude. Then he took out a slinky--a steel spring that expands to several yards or contracts to a few inches --stretched it across the table, moved it so as to demonstrate wave length, asking questions such as "what happens to the wave length when I increase the amplitude?" The overhead projector showed a chart with the amplitudes of the different rays, to show the spectrum of visible light. He then directed pupils to six stations where he had set up demonstrations of properties of light. One was an aquarium with a mirror at the bottom. The pupils were told to shine a flashlight into the mirror at an angle and measure the two angles with a protractor, then to explain what they found. Later he reviewed what they should have discovered at each of the six stations. The lecture proceeded from there to the next point.

Mr. Taylor is enrolled part-time in a graduate program in counseling. This side of his personality shows through in his class and his philosophy of science education:

> *I carry on a reality therapy in my classroom, like Glasser's Schools Without Failure. I try to base my class on that. That's where you make a kid be responsible for his actions. . . . Responsible behavior builds a success identity. . . . I establish for my success identity that no person will get less than a C in my class if they have demonstrated responsible behavior in the laboratories and have tried on all the tests to do their best. . . . In a majority of cases, this is successful. . . . I've removed the pressure of the tests so they do better on the tests. You can't get an accurate picture of what the kids know with all the pressure and anxiety that's built up from the tests.*
>
> *The most important thing about science education is treating the students like human beings--thinking of student first instead of the subject first. You teach alot more subject in the long run when you treat them like people. . . . You have to find their level and teach at it, otherwise you've lost the battle as a teacher.*

The contrast between Mr. Taylor at East and Mr. Smith who teaches physical science at West is worth noting. Both teach the same general content and both classes are oriented around science activities. But the difference in philosophy and style is evident in Mr. Smith's interview (he calls himself the "last bastion of intellectual rigor in the district"):

> *I never talk down to the kids. I lose some of them, but listening is another study skill; they have to learn to stretch a little. . . . You know, if you have to work with the hogs you get dirty with the hogs. If you get down on their level you'll become infantile too. I tell them: "You're not going to understand everything I say. But stick with me, if you'll listen we'll still be able to communicate." I'm sure I turn some of them off. But you've got a lot to compete against. . . . I know I'm not going to have them, all of them, all the time, but I wouldn't even if I talked on the second-grade level.*

In many ways, Mr. Smith is like teachers in the three secondary science departments. The science teachers are more likely than others to have had thorough undergraduate, graduate, and institute training in academic disciplines. Like Mr. Smith, several have had vocational experience in some field of science. Most importantly, they have an identification with something outside, perhaps larger than, the public schools; namely, the scientific enterprise and the community of scientists. They are more likely to have connections with universities and scientific institutes, to value these contacts, to attend science education conventions and read the literature of their profession. These few teachers have kept open a window on the larger world of ideas. Most teachers have only a mirror that reflects the values and ideas already dominant in the public schools.

East Junior High Math Program

Like the science department, the math teachers work hard together as a group. They operate as one large team that during the day is located in one space about the size of three classrooms. The algebra classes, however, are taught in separate, quieter quarters. Although there are usually four teachers holding forth at a time, there is little interference across the partitions that separate the small groups.

Once a week the teachers get together to discuss math education and their program--what problems they are experiencing and how they might improve. Their joint efforts have been responsible for an individualized math program which they decided to build independently, as a way of coping with the highly variable math skills the students brought with them. The teachers examined published curriculum packages, visited school districts with a program they viewed as compatible, and asked the district office for money to support collaborative development. Once the program was developed, however, the teachers concluded that over half of the students could not work effectively on their own. This year they made an adjustment. Starting with everyone (except the students who elected algebra), they reviewed whole numbers and fractions, then gave a placement test. The high ability and eager students were put into the individualized section. The rest were grouped by ability levels and are taught in structured classes.

By standing in one spot in the math area it is possible to observe one class trying valiantly to fill in a multiplication table, another working on areas of rectangles, another doing problems on improper fractions and mixed numbers on work sheets, another hearing a lecture on number theory. The students who are working on the individualized materials are all doing different things. In this program a student sets his own goals: the number of units he wants to complete and the grade he wants to achieve on the units. He begins a unit with a pre-test. Unless he passes it, he receives the unit, which has objectives, the instructional material, sample problems, problem assignments. The students work through these, getting help as needed from the supervising teacher. Extra problem sheets are available. Then the student gets a post-test from the aide. If he makes his grade goal, he goes to the next unit. If not, he studies supplementary materials and takes a parallel post-test. A second failure lands him temporarily in a classroom instructional unit. The students who can work this way enjoy going farther and faster than normal. Some are ready for geometry by the time they enter the ninth grade.

The math teachers work hard on their program, even electing to evaluate it themselves by pre- and post-testing student achievement. They talk about getting together and writing up a lesson or revising a unit, or deciding how to solve a problem in the program. This is clearly a group with shared expectation for working, reinforced by the mutual support of its members.

East Junior High Social Studies

The working groups emerging in science and math have not evolved in the social studies program. Cultural geography is taught in the seventh grade, American history in the eighth, and civics and state history in the ninth. No common philosophies or compatible styles unite the three courses.

The ninth-grade course is popular with students, the first one that they regard as relevant. The team of teachers combine formal presentation of governmental and political facts and ideas with individual student work on case studies. The seventh graders cover map skills using Science Research Associates kits and area cultural studies using lectures, films, and the Scott-Foresman Spectra Program on People of the World.

The eighth-grade program merits closer examination. Until the present graduation requirements were altered, this course was the only experience many students would ever have with American history. Two teachers, Mr. Tyler and Mrs. Harrison, divide their classes in two groups according to reading ability. Each group then receives a separate textbook. Typically one day a week is spent with the students reading from their texts. Another day is set aside for a lecture or "simulation game." The next day is for free reading, the next for a film and the last for current events. War is the theme of the class. There is a library shelf of books for each American war. War photographs decorate one wall. On the blackboard is a matrix, rows of which are the wars and columns of which are causes, results, opponents, dates, and leaders. "Mr. Tyler feels that America's history is the history of her wars," Mrs. Harrison stated.

> *[Observation of American history classes] Mr. Tyler divides the groups and reminds everyone to take their projects home (these are models of colonial buildings, forts, etc. that the pupils have constructed). He begins his lecture with the question "Why do you think that the colonists wanted to get away from England, wanted to break the ties?" A student answers in terms of the absence of religious freedom and opportunities to acquire riches. He says no, that's why they came over in the first place, and reviews that material. "Now we get to a different situation. Colonists were tired of English control. Colonists believed they were there to develop a life for themselves to give to their kids. . . . Colonists felt they had separate problems from England but their voices weren't heard. . . . They felt they needed a representative to go over and tell their problems to England. . . . Colorado has special problems, doesn't it? What if Colorado didn't have any representatives? . . . At that time most people didn't want to separate. They just wanted to send a representative over and say, Hey, we've got special problems! . . . But there were terrible conditions in England like Dickens wrote about in Oliver Twist and Tale of Two Cities. . . . The idea started changing. The laws weren't being obeyed cause we said "We didn't get a chance to say yes or no. You're taking advantage of us, we aren't going to obey. We're not going to play that game. Chuck it! We'll take your tea and dump it into the ocean."*
>
> *The teacher continues in this free-wheeling style, devoting no more than a few sentences each to the Declaration of Independence, the war itself, the Articles of Confederation ("They didn't work so we dumped them"), the Constitutional convention and the Bill of Rights, ending with the interesting note that in the U.S. House of Representatives there are now 350 Representatives, 7 or 8 from Colorado.*
>
> *Across the aisle, Mrs. Harrison has the other two groups. Her lecture, designed to help the students fill in the war matrix, consists of perfunctory answers to rhetorical questions ("Why did we fight the Revolution? Why were we so mad? Who were some leaders that came to the forefront? What advantages did the colonists have?") and including this astonishing statement: "I won't go into the Constitution; you'll get that next year and you probably would be really bored if I went into it this year."*
>
> *What follows is a simulation in which the students are divided into teams of colonists and English and asked to debate and then decide whether to go to war. Unencumbered by facts or understanding and unchecked by Mrs. Harrison, the students' debate quickly assumes the tenor of a parent-child confrontation.*

"You wouldn't be anything without us."
"Don't let it bother you."
"Indians would wipe you out without us."
"We work our tails off and you get all the profits."
"We helped you get started and now we need money from your resources."
"Why can't we have our independence? You've got yours!"
"All you guys do is sit and drink tea. We're all in shape."

And, of ourse, at the end one student expresses the will of the colonists.
"We call you out!"

ELEMENTARY SCHOOL PROGRAMS

There are commonalities among the separate elementary schools: common textbook adoptions, district curriculum guides which specify what content and objectives should be covered in what grade levels, and subject matter coordinating committees. Aside from these centralizing forces, the elementary schools have evolved into quite independent social structures. In fact there is some question about whether these centralizing forces are enough to counteract the strong tendencies of territoriality and autonomy. The philosophy and style of the principal and the traditions and social structure within a single school probably have most to do with the educational program there. If the principal does not retain for himself most of the authority for managing instruction, the educational program fractionates even more, now determined by the individual teacher. The result is that within a single building, so many different philosophies and personal styles are being acted out that no general, district-wide "educational program" could be described. There were almost no reliable differences between the schools observed that weren't swamped by the variability among teachers within each single school. This is less true in teaching math, which everyone agrees is an important subject, than it is in science and social studies, where the teachers have much discretion.

One important characteristic of elementary schools in this district is whether or not the school is participating in PLAN*. Several years ago the superintendent suggested the adoption of the Westinghouse PLAN* program and it was accepted by the principals of several elementary schools. PLAN* is an individualized, computer-managed instructional program in language arts, math, science and social studies. The heart of the program is the Teaching-Learning Unit (TLU) which has one learning objective (e.g., "Divide fractions or functions and whole numbers") and learning activities ("Use the Fraction Tiles . . . Do Part One of the Activity Sheet . . . Study the picture on p. 256 of Mathematics Around Us and do all the problems . . . Play 'Divide and Conquer' . . . "). A teacher works out with one or more students which TLU's will fit together into a Program of Study (POS). The student takes a test at the end of each TLU and POS. A computer-management system records the TLU's begun, completed, and the test scores. The teacher becomes more of a tutor, counselor, or manager with this system and less a dispenser of information.

Many points for and against this system have been raised. None of the published arguments anticipated the furor raised by people in this community against a system so different from the one they had had in school. One can hear many PLAN* horror stories in this district --how some of the pupils simply stopped functioning altogether and wandered around the classroom; how some parents were so angry that they would come to school everyday, sit in the back of the classroom and glower; how some parents put their children into private schools. Fingers were pointed in many directions. The board of education made a policy called "Options in Education," which sounded like alternatives but really was only a way to get traditional classes operating in PLAN* schools. Now there are only four schools which use PLAN* and these have traditional classes as well.

Bringing up PLAN* (almost like mentioning open-space buildings) is guaranteed to precipitate an argument among parents, teachers, or even the students themselves. "My mother thinks I do better under PLAN* than traditional," one of the fifth grade girls said, "because I can go at my own pace." (The ability of pupils to pick up the educational jargon is amazing.) A mother said that PLAN* should be abolished because it was too expensive and "kids can't concentrate when there are so many distractions." One teacher who was forced to use it one year said, "The kids were just copying each other's work." Another teacher who seemed to be using the system quite effectively said the following:

> *The fact is that PLAN* doesn't work for all kids. Some of them just seem to need somebody standing over them all the time, saying "today we will work on X and you'll have to have it done in an hour from now." Most of the time under PLAN* the kids were managing their own time. I pace them by saying they have two weeks to finish a POS, but then they go on and do it. These are the kids that don't need constant attention. I think we had problems with PLAN* more because of the way it was introduced. We had never seen the materials before. We had inservice on the system but we were afraid to deviate from it at all, we couldn't adapt it to our kids. Then we got really defensive about it because parents were coming in and attacking us. Parents were not informed in advance or prepared at all and then, boom! All of a sudden it was TLU's and POS's and computer printouts and achievement test scores. The whole thing was just totally alien to them. Now we can sort out the kids who can perform under PLAN* and we've learned where we can follow it, or deviate from it or write our own TLU's or whatever. Now I like it. I think it works out well.*

Whatever the merits and faults of PLAN*, it does focus some attention on the low priority areas of science and social studies. Although each teacher must cover the two subjects, how they do so, with what emphasis and concern is an individual matter. "We do math and reading in the morning when the kids are fresh. We do science and social studies, in the afternoon, if there's a chance," one teacher said. Although there was a schedule of both subjects, actually finding instruction taking place was sometimes like tracking the Sasquatch. Requests to observe science and social studies were sometimes met with "You should have come yesterday, we're doing vocabulary today." "We're baking cornbread in science today." "I'm not going to do anymore social studies until after Christmas." "Social studies? Uh, yeah, come back tomorrow."

On the other hand, when an individual teacher was adequately trained and so inclined, instruction could be excellent. One primary teacher had organized a very sophisticated package using the newspaper to introduce the children to society, even government and economics. One sixth-grade teacher gave a lecture on the functions of the three branches of government. After the material had been assimilated the students entered into a role-playing with teams of students acting out the roles of Senators, Congressmen, the President and the Supreme Court justices, going through the process of how a bill becomes a law. A PLAN* teacher was observed guiding small groups of students through a series of science investigation and discussion of their predictions, findings, and conclusions. A teacher in a traditional class was observed conducting a review of science material that they had learned, and the amount was considerable. "They like science because I like science," she said. Another sixth-grade teacher was using the science text as a way of teaching study skills: taking notes from lecture, outlining chapter, writing down main ideas.

One sixth grade teacher had more science models, supplies, and equipment than many whole schools. "I bug the junior highs. . . . We try to do two science activities a week. . . . I take every science class I can get my hands on. There are about fifteen of us in the district [elementary schools] who identify ourselves as science teachers. The others don't know too much about it or pursue it too diligently."

The district adopted the Concepts in Science series with its accompanying portable Classroom Laboratory, several of which are available in each building. Science resources are plentiful, but the allotment of each school's budget is up to the discretion of its principal.

The training and inclinations of individual teachers determine not only how much science is taught but how it is taught. Almost every philosophy is evident. Some teachers merely have students read and answer questions from the texts. Others provide "hands-on experiences." Still others prefer to demonstrate the investigations. The textbook series is oriented around the "big ideas in science," but some teachers confess that they themselves don't understand the big ideas. "Messing around with science" is almost completely absent as an approach to science education.

A lack of training in science and social science disciplines was perhaps the biggest obstacle to the elementary programs. One sixth-grade student interrupted a review of ecology concepts to ask, "If scientists can cause an explosion by splitting an atom, why don't you get an explosion when you saw a piece of wood in two?" Another chimed in, "I've been wanting to ask this question for two years. What's the difference between an atom and a molecule?" "Those are both good questions," said the embarrassed teacher. "I don't know. Why don't you look it up and make a report on it. Now we've got to get back to this review." Later she confessed that the only science she had had was one year of biological sciences in college and one "module" in science education during teacher training. She could keep up by studying the elementary textbook, but departures such as the one that day caught her unprepared.

One common element in the district's elementary science program is Eco-week, an experience in environmental awareness for all sixth graders. This project is the brainchild of Mr. Johnson, the district science coordinator. The sixth graders go, one school at a time, to a mountain camp ground for three days. Their teachers who have received in-service training for Eco-week supervise their activities. They conduct a forest investigation (e.g., determining the age and growth patterns of trees), water investigation (e.g., investigating the physical characteristics and aquatic life in running and stagnant water), soil investigation (e.g., tracing food chain, discussing man's effect on the soil), animal investigation (e.g., identifying habitat and inhabitants), compass activities, and a scavenger hunt (e.g., "find evidence of animals changing nature," "find a piece of quartz," "find evidence of wind erosion"). In all, the students are encouraged to use their senses to appreciate more fully the environs and to communicate their thoughts and feelings. Back in town the students and teachers conduct investigations of the city water system (e.g., trace Fall River's water system from source to river below the sewer treatment plant and investigate water quality, treatment of water for human consumption and after human use), and an urban study ("tour the local city community and identify common environmental problems caused by the needs of man and list possible solutions").

People throughout the district point with satisfaction to the Eco-week program. The pupils love it. Many of the teachers appreciate the chance to play a different role with the students, more like a cooperative partnership. The content, unlike some of the academic science, is more accessible and less threatening. One teacher expressed it this way:

> *After I had done it a couple of times I realized that what was nice is that we were all up there and working on one thing. I mean I didn't have my mind on getting my kids to the music room on time, or what I was going to do about math today, or how I was going to fit in the film that was supposed to come yesterday and didn't, and whether an outraged parent was going to pop in. We were relaxed but really working at the same time.*

CONCLUSION

Three statements conclude four months of watching the teachers of Fall River, probing their motives, listening to students, parents, and administrators, reading the records and studying the evidence.

Virtually nothing meaningful can be said about the Fall River "science program" in general. The district has developed a science curriculum packed with articulated objectives and brimming with specified content; yet there remain differences in content, method, and sense of purpose from one grade level to the next, among schools, among departments within schools, even from teacher to teacher. This diversity and complexity, even within Fall River, suggests why national efforts to reform the curriculum become transformed, attenuated, or lost entirely before they reach the classroom. The schools have lives of their own, existing as organisms exist, to "be on with it," perpetuating themselves and protecting against assault from without.

People in schools are conscientiously doing the jobs they have defined: tutor, scholar, but also at times, counselor, steward, custodian, and social director.

Teachers must juggle the expectations of the invisible, distant, and mostly impersonal profession of science education and the local, powerful, and relentless demands of teaching. The two roles do not necessarily conflict; but the latter usually overpowers and preempts the former.

MARY LEE SMITH

Mary Lee Smith brings to her participation in the CSSE project a wealth of experience as an educational evaluator. Currently, she holds the positions of Research Associate in the Laboratory of Educational Research, University of Colorado; Director of Evaluation Research Services, Boulder, Colorado; and Counseling Psychologist at the Student Life Center, University of Colorado. Included in her previous experience are six years of work in educational evaluation and research on such topics as experimental, case study, survey and assessment methods. Her major research interests are in the outcomes of psychotheraphy and counseling, and in sex bias in counseling and psychotherapy.

Recipient of a Ph.D. from the University of Colorado (1972), Mary Lee is the author of numerous papers and articles. Among her major publications are: "Influence of Client Sex and Ethnic Group on Counselor Judgments," Journal of Counseling Psychology, 1974, 21(516-521); notes on "Perspectives on Counselor Bias: Implications for Counselor Education," The Counseling Psychologist, 1973, 4(93); and "Sex Bias in Counseling and Psychotherapy," a research paper for the Laboratory of Educational Research, University of Colorado, 1977. She has co-authored (with Gene V Glass) "Meta-Analysis of Psychotherapy Outcome Studies," The American Psychologist, 1977 (in press) and "Factors Influencing the Evaluation of Educational Programs: Analysis of Judgmental Policies," Occasional Paper #77-1, Evaluation Research Services,

1977. Also, along with R. Gabriel, J. Schott, and W. L. Padia, she has written "Evaluation of the Effects of Outward Bound," included in Evaluation Studies Review Annual, Volume I edited by Gene V Glass (Beverly Hills: Sage Publications, 1976).

Among her hobbies are tennis and cookery, and she cites as her biggest accomplishment, "mastering the top-spin backhand approach shot." (So much for cookery, Mary Lee, but what about tennis accomplishments?) Latest books read include TM for Tots and Principia Mathematica. Favorite Scotch? Of course--Barry MacDonald.

Chapter 3

SCIENCE EDUCATION IN THE ALTE SCHOOLS: A KIND OF CASE STUDY

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Alte is one of the oldest suburbs of a large midwestern city, but has developed an impressive commercial trade center in recent decades and has a very substantial tax base. Containing some of the most beautiful residential sections in the midwest, it is an attractive magnet for professional and executive families. Among the major attractions, the Alte Public Schools are certainly to be counted. The high school studied is reputed to be one of the best preparatory schools in the larger metropolitan area; it has a number of tuition-paying students from other communities, as do the junior high and elementary schools.

The resources of money, high educational level of the population, an experienced and well-trained teaching staff, and extremely competent professional leadership could make it the envy of many another district. Yet it is very interesting to discover, as Lou Smith's case study shows, that some teachers complain of the problems of student motivation, of poor articulation between levels of school curriculum, and of inadequate reading and arithmetical abilities by the time students reach the secondary schools. Pupil and parent concerns have resulted in the formation of an alternative high school whose enrollment is limited to approximately forty-five pupils. Thus, one lesson to be learned from the case study of Alte is that the resources educators clamor for do not, in themselves, directly solve all the problems teachers, pupils, and parents perceive.

Substantively, Lou Smith has another point to communicate. That is, the development of a district through its history is not lost in its present form and organization. The constraints of gradual development are real ones, for a school system can only progress by small increments in the general direction in which the school and community leaders would like to see it go. Through a process which is essentially political, in the best sense of that word, the leaders discover the support that is or is not available for different moves, directions, and goals.

Smith's second major point, however, is both methodological and theoretical in nature. The problem of discovering what makes a school district a district, i.e., a functional social organization with a common sense of direction and professional ethic, is a new focus for a curriculum-oriented case study. Though this focus promises to provide a clear picture of the science, math, and social science programs, how it is to be researched, especially in the time of one semester, is the problem with which Smith struggles. He finds an essential and continuing tension between leadership functions among school personnel and parents and the child-focused teacher-parent relation. Most parents perceive the district science program as the individual teachers who teach their children, and their feelings may be positive or negative. But for some parents, who might be classified as activists or regulars in school affairs, there are more general issues. Some of the faculty and some of the parents have direct access to official decision makers, while others work directly with teachers or principals. Another related methodological problem is that many teachers implicitly take for granted the social structure of the district; they don't explicate it and make it problematic for themselves.

The progress Smith makes methodologically on studying a district qua district is an important indicator of what case study research is capable of and a strong guide for future studies of school curricula.

THE PERPLEXITIES AS PROLOGUE

In the last decades of the nineteenth century a small group of individuals in the town of Alte[1] gathered together and decided that their community needed a school. Notices were distributed to taxpayers, a town meeting was called. This spring meeting elected the first school board and voted money for a school building. By that September a one-room frame school with forty-eight children and a teacher was in operation. Twenty-five years later, 1907-08, the highschool program began in one room and the upstairs corridors of the new brick grammar school building. The curriculum was algebra, Latin, and English. Today there are a dozen buildings, several hundred teachers and professional personnel, and several thousand pupils, studying literally dozens of "courses."

In 1977, almost a hundred years later, NSF approached the Alte District to do a case study of science education: natural science, social science, and mathematics in grades K-12. Further, NSF wanted policy recommendations. Immediately, the analyst with such an agenda is faced with a series of questions: What is the status of science education today? How is it to be conceptualized; that is, what are the rubrics, the categories, that denote the regularities? Are there differences in the way participants in the system construe these regularities? Is there some better, more ultimate, way they can be conceived? Once these accurate descriptions and categorizations are in hand, how does one explain the transformation of a one-room school house as a district into the contemporary district? Or in more particular form, at the highschool, how does a three-course curriculum, only one of which is "science," evolve into a curriculum of twelve science courses, eleven mathematics courses, and nine social science courses (one of which has five alternative components)? What seems a simple question soon becomes intriguing and a bit ironic; given NSF's broad definition of science education, is natural science explanation the same as social science explanation? Philosophers such as Hempel argue yes; but others, Toulmin and Peters for instance, say no. And then, as we have come to find, social science in Alte High School is mostly history. Is historical explanation the same as natural science or empirical social scientific explanation? Hempel continues to argue yes while Scriven and Dray, among others, say no. To whom do we turn to provide a metatheoretical context on to which we can frame our comments?

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[1] All proper names of places and people have been coded for anomymity. In addition, slight changes in "nonessential" elements have been made to disguise the district and its personnel. It goes without saying that our indebtedness to the Alte District is great. We were permitted free access to classes, personnel and public documents.

If that were not enough of a set of problems, perplexities arise concerning the nature of educational theory. Is it a form of scientific theory or a form of practical theory; that is, where do values fit? Is educational theory mostly one or the other, or is it best conceived as a little of both? Here again, the philosophical experts seem to disagree--O'Connor argues for mostly science ("Do your ethics independently," he argues) and Hirst and Peters (and some others) argue the irrevocable integration in the key concepts--education, curriculum, teaching. On the American Scene, at the level of curriculum, Schwab and Walker argue for educational theory as practical and deliberative. Interestingly, both were trained as natural scientists and have taught science. In my own view, when NSF asks for recommendations it is implicitly asking for a mix of ethical and scientific thought.

A final personal note: in the course of explaining to teachers the nature of the project, as part of the informed consent procedures, the observer found himself offering a personal rationale as part of his involvement in the project. It went like this. "In the past I have been intensely involved in studying classrooms and individual school buildings. I've never tackled a school district. I don't even know how to think about one. To me this is the most exciting intellectual issue in the project." Mostly the teachers responded with wry or amused smiles and grins. The social studies teachers thought the observer was out of his mind (and his depth!) and spent an hour telling him so as they quizzed him about the project. The latter was to the point of a comment a few days later from an administrator friend, "I hear the social studies teachers gave you a bad time the other day." In his own perception the observer felt as though, "I gave as good as I got," and felt pleased with the initial observations of the quality of mind of the social studies faculty.

The major methodological procedure used to attack these problems was participant observation. This is a collection of techniques with a long history in anthropology and sociology and a shorter history in education. Psychology has traditionally phrased some similar research styles as case study inquiry or clinical method and has had an ambivalent and troubled relationship with it over the years. In our use of participant observation we mean essentially that the researcher participates in the ongoing events of the system--classrooms, schools, committees and individual lives. In part, he is stranger and friend. During this, he observes, talks to people, takes notes, collects documents and, most of all, attempts to understand what is happening. While we have tried to capture the methodology in numerous formal accounts, for procedural purposes a brief listing of "Data Sources" is presented in Figure 1. This was compiled while an early draft of some of the ideas was being prepared on a sunny afternoon in early March. It is only a partial listing for illustrative purposes. It does indicate, early on, the varied settings, people, and events we tried to sample.

Insert Figure 1 about here

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1. Administrative interviews: superintendent, principals
2. Extended teacher interviews with several former students and colleagues
3. Beginning observations of classes and teacher interviews
4. Instructional TV--program on Atomic Safety
5. Junior High Assembly--Rural Highlands as an historical, cultural, and commercial region
6. Meeting of sixth grade parents and junior and senior high staff in Math and English
7. Open House at the Alternative High School
8. Meetings of the steering committee for Northcentral visitation
9. Luncheon conversations at several schools
10. Before school coffee klatches at several schools
11. Extended interactions with the research coordinator: shared interviews, shared observations, long substantive and methodological discussions

Figure 1. Illustrative Data Sources: Settings, People and Events (as of 3/16)

From such initial questions--foreshadowed problems, to use Malenowski's term--and from such "observations" of the school and from the cumulating records, we have tried to develop a descriptive and analytic account of science education in the Alte School District. The several sections are organized into these themes:

1. The Perplexities as Prologue
2. The Transformation of the Alte District
3. Conceptualizing a District-Wide Science Education Program
4. Areas of Controversy
5. Conclusion
6. Methodological Appendix
7. References

THE TRANSFORMATION OF THE ALTE DISTRICT

An Overview

While we have not done a formal history of the Alte District, it seems helpful to sketch a few items on a time line over the last hundred years.[2] Such a chronicle will facilitate thinking in several ways, by providing:

1. an account of the lay language of the items considered important by general historians of the Alte community;
2. some points of comparison and contrast to highlight the current program of the district;
3. some of the factual data from which we can build a more analytical and interpretive account of science education; and
4. a framework of the "longer term large changes" into which we can incorporate some of the more recent smaller changes in science education.

In part we are trying to move toward policy issues by explicating "naturalistic/historical" processes of change. Most of the data come from several key sources. A general account of Alte City was written by a local newspaperman and published in 1976 as part of Alte's Centennial and the nation's Bicentennial.[3] Two other accounts are secondary sources in the sense they are histories of the community, but they are also primary sources in that they were written by seventh and eighth-grade pupils and formally published, one in the early 1930s and one in 1976. More will be said of the latter, as a part of the social science program. In addition, high school annuals, curriculum guides, and several reports have been utilized as primary sources. Finally the Alte School News, in existence a dozen and a half years, published by the district for the patrons, has been consulted.

The Community and the Schools

The historical accounts are essentially in everyday lay language. In Figure 2 a one hundred year time line has been produced. The categories of events, strands, if you will, have been indicated on the ordinate. As the vignette in the prologue indicates, concerned citizens of the community met in 1880, picked a school board, assessed taxes, contracted for a building, hired a teacher, and began an educational program for some four dozen children. The story is an intriguing one, representing a mix of buildings, personnel, pupils, programs and community. In many ways it parallels the development of much of America.

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[2] The ideas for incorporating this approach to the case study were stimulated, in part, by McKinney and Westbury's (1975) essay.

[3] We have coded these documents as well; neither the problems nor the strategies and tactics re anonymity in a mixed historical/contemporaneous account have been spelled out in the literature.

Insert Figure 2 about here

The community changed from a small town, almost rural, to a major suburban community with a strong commercial tax base and a citizenry of middle to upper social classes. However, the dominant or model group is upper middle class, "executive city" as some writers label it. With the first private subdivisions, zoned in 1910 into one-and-a-half-acre lots, much of what now exists seems to have been determined. This coalescing into a community carries with it the development of a perspective, a point of view, about what is expected in the education of the children of the community. This perspective has jelled into a demand for "academic excellence." In the elementary schools, "excellence" is defined in terms of attitude (development of a desire to learn) as well as achievement (especially in reading and mathematics). The junior high is to provide a transition into the disciplinary studies of the high school. There, a program of knowledge and skills productive of learning, high college board test scores, and entrance to colleges and universities in general and Ivy League schools in particular (for the "best" students) is demanded. In addition, the community had/has the economic resources and the political power to implement its point of view.[4] In effect the community perspective had become a mandate.

Within the last year, the school board hired an outside educational consultant to conduct an intensive public opinion study, "How citizens in Alte view their schools." While the report contains a number of items relevant to our later specific interests, the overall reaction is appropriate here. The question: "On the whole, would you rate the public schools in Alte as excellent, good, fair or poor?" The responses were 68% excellent, 27% good, 2% fair, 0% poor, 3% no opinion (these latter responses came from citizens who had no children in school). According to reports from the interviewer, he had not surveyed a district with a higher rating of satisfaction with the schools. At a general level, a congruence exists between what the community wants and what the school system does. Positive sentiments are the outcome. It is important to note, however, that a vocal

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[4] Consistently, the Alte School District per pupil expenditures are in the highest ten percent of the metropolitan area.

		1880	1890	1900	1910	1920	1930	1940	1950	1960	1970	1980
COMMUNITY	Citizen Involvement Size SES Taxes	1st School Established (1880)			1st Private Residential Area Zoned 1 1/2 Acres (1910)	Executive City (1920-)		Post WW II Development Expanded Tax Base (1946)			Survey of Citizens' View of Schools (1976)	
PROGRAMS AND BUILDINGS	Elem.	Elem. Program 1880- 1st Building Built (1880)	New Elem. School Building (1892)	Opening 2nd Elem. School		New Elem. Schools (1929-30)			Integration: Closing of Black Elem. School (1954)			
	Junior High						Junior High Program (1938) Junior High Opens			New Junior High Building		
	Secondary			H.S. Program Begins 1907-08	H.S. Accredited with 23 units (1911) Opening of New H.S. (1915-19)				Current H.S. Built (1952)		Alternative High School 1972	
PERSONNEL		1st School Board Elected 1880		1st Supt. 1908		3rd Supt. 30+ years Tenure		1st Small town Supt. recognized by AASA (1940)				

Figure 2. A Partial Chronicle of the Alte School District

minority opinion does exist in the community. One of the issues on the recent television news and in brief accounts in the local newspapers is the concern about the adoption of "untested innovations" and the children being "guinea pigs" in the process.

Such an illustration makes an important but simple point, an oft neglected truism, relevant to NSF's interest in science education. Any kind of change in curriculum and teaching will produce positive and negative reactions in individual parents and citizens. Those reactions, as they aggregate, become direct political forces in school board elections and indirect forces in the day to day workings of the schools. Analyses, scientific, theoretical, or practical, which ignore the latent meaning in a simple illustration such as this do an injustice to the complexity of the reality itself, and to the actors who live and work in the system.

A final word about the social structure of the community seems necessary. Religiously the community contains a mix of Protestants, Catholics, and Jews. Pre-World War II, it had a "Jewish problem," e.g., neighborhoods with restrictive housing covenants. Those covenants and practices are gone now. Racially, the community is almost all White. As yet, there is no "racial problem." A story, going back a hundred years, does exist, i.e., when the original 1880 frame school was no longer large enough, a new brick school was built. The frame building was moved to a new location; it became the "colored school" for a number of years. After World War II, though, the Black community disappeared as property was bought for commercial development. Economically, our earlier account indicated no "social class problems"; the community is basically homogeneous, upper middle class with a strong tax base financially supporting the schools. For this report these conditions are givens, a context for consideration of a particular science education program. For the social analyst and critic of American society who is concerned with broader issues of social conflict, pluralism, equality, and "success" in the American Dream, these conditions could be taken as problematic.[5]

The Alte Schools

During the first twenty-five years at the turn of the century, the school district--that is, the one-room school-- was reasonably stable. In the years around 1910, a series of interrelated events occurred.

1. The population of the town of Alte increased.
2. Parents at the end of the district farthest from the school wanted a school closer to home for their children. A second elementary school was built.

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[5] Once again, the key role of values in a general theory of education seems evident.

3. The old frame building of the first school had been replaced with a larger brick building.
4. The high school program was begun.
5. The first superintendent was hired.

Later, concomitant with the community consolidation in the twenties, thirties, forties, and fifties, the school district's administration enjoyed the long-term tenure of its third superintendent. He led the district--carefully, shrewdly, some say benevolently but autocratically, and with some professional notoriety--for over thirty years. He built the elementary schools, the junior highs, and a new senior high school. The program expanded and became more complex and more specialized. He himself was one of the first nationally recognized small city superintendents. Through most of his three decades he both knew what the community wanted and helped shape concretely those expectations.

For illustrative purposes, the changes in the general school curriculum can be evidenced in the growth of the high school curriculum.[6] Before 1907-08 those youngsters who wanted a secondary education enrolled in one of the nearby City high schools. As the program began for the ninth graders, English, Latin, and algebra were the first subjects. The program grew in size and complexity and through a series of temporary quarters. After World War I, the first high school building was built and staffed by a dozen teachers. The first high school annual indirectly describes the program by listing the subjects taught by the teachers. Currently in 1977 the program includes a dozen courses each in language arts (English, journalism, theatre), social science, science, mathematics, fine arts (art and music), practical arts (industrial, commercial, and homemaking), foreign language (French, Spanish, Latin, and German), and miscellaneous (physical education, driver education, psychology, etc.). Figure 3 presents these in graphic form.

Insert Figure 3 about here

Now, in the late 1970s, the environment is shifting once again. Alte, like many school districts, is faced with declining enrollments. The most deep rooted general concern of all the teachers in Alte, including the science teachers, is this spectre of declining enrollments. When the few non-tenured teachers in the faculty are gone, and the district is highly tenured, what happens to the tenured faculty. What will be the role of excellence and competence, the role of age and seniority? Most certainly one of the hoped-for consequences by the administration, board, and citizenry is toning up the system, self-development by staff in

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[6] Once again, the need for a thorough historical analysis is quite clear.

English	Accreditation of the high school: 23 units	Normal Training	Language Arts (English, Journalism, Theatre Arts)
Latin		History	Social Sciences
Algebra		Economics	Science
		Science	Mathematics
		English	Fine Arts (Art & Music)
		Music & Art	Practical Arts (Industrial, Commercial, Homemaking)
		French	Foreign Languages
		Manual Training	Miscellaneous
		Domestic Science	
		Commercial	
1907/08	1911	1918-1920	1976-1977

Figure 3. The Changing Secondary Curriculum in Alte

overcoming "softness and flabiness," energizing some of the teaching core which has gone stale. Another outcome feared by many of the teachers is the [chance or] occasional negative phone call of a parent to a board member, or the fawning by fellow teachers to administrators or board members. In part, administrators may be faced with hard choices; in part, that's what they are paid to do and expected to do.

In brief, a variety of planned actions are underway as the district tries to cope with these changes. Most of them are outside the scope of this analysis. But the issue becomes a part of every individual's perceptions, thinking, and acting. The implications for an organization such as NSF seem both obvious and obscure. The expansionist excitement, the unlimited opportunities, the predominance of hope of the late fifties and early sixties is gone. If broad scale curriculum development and implementation was difficult then, it will seem like a teaparty compared to the present and immediate future. Risktaking is precarious at best, foolhardy or dangerous at worst in such an environment. Introspection, reflection, seeking an identity, cautious and more carefully and specifically aimed change seems to be the atmosphere in Alte. Aspects of these items will be elaborated upon later at several points.

Initial Implications

Overall, several interesting aspects appear to be generalizable. In looking at such a brief chronicle there seem to have been implicit in this several theoretical elements:

1. Contextually, similar events had been and were going on in small communities all over America; models, legal requirements and procedures were present.
2. Citizens, acting individually and together, were defining goals, designing means, and actualizing those events.
3. In what seems to be an incredible kind of social stability, a hundred years later citizens are still expressing opinions (now with the help of public opinion surveys, as well as face to face comment, criticism, and support) and still acting through a local board of education.
4. The educational system which was established--governing board, curriculum, teacher, pupils, and a specified time and place--is systemic. It contains the major interdependent elements in a simplified microcosm.[7] Those basic elements persist even in the midst of overt change.

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[7] A similar, but more philosophically grounded view is presented by Gowin (1976). He speaks of these elements as "educational commonplaces."

5. In 1907-08 increasing population and a concomitant increase in complexity of the organization (three elementary schools and the beginnings of the high school) seemed to raise problems of coordination and responsibility; the first superintendent was hired, thereby making for further complexity of the organization.

6. Complexity is an intriguing concept. So far, increasing complexity refers to at least these phenomena.

   6.1 Additional numbers of the same units--more elementary buildings, more teachers, more pupils
   6.2 New kinds of units--a high school, later a junior high
   6.3 Increasing specialization of positions--individuals who don't teach but administer and coordinate; principals and the superintendent, special kinds of teachers
   6.4 Increasing hierarchy of governance and control; what originally was: citizenry-board-teacher-pupils becomes: citizenry-board-superintendent-principal-teacher and pupils. Later, assistant superintendent positions and assistant principalships at the high school were created.

7. Finally, as the present social environment of the schools changes--in this case, declining enrollments--major changes begin to occur at all levels and in all parts of the system. Individuals perceive the changes as a "new ball game"; they conceptualize events differently: "a new set of rules," new interpersonal relationships, "teams," are formed.

In short, even a brief historical overview gives an observer a context of stability and change in the community and in the schools.

An Analysis of Recent Change: IPI and the LRC's

As has been indicated, developing an understanding and explanation of the large scale transformation of the district's educational program over one hundred years would require the efforts of an historian. We have made some tenative allusions to the shaping of the community as upper middle class with the correlated expectations for an academic college preparatory program in the schools. For a more detailed analysis of within-school changes, it seems instructive to take an instance or two of recent changes and chart them in more detail. The situations are the correlated development of the elementary school Learning Resource Centers (LRC's) and the modification of the elementary mathematics program through the introduction of IPI math, Individually Prescribed Instruction in mathematics.

The Context, Beliefs, Interactions, Sentiments

As one talks with principals and teachers in the Alte Elementary Schools, the term "individualizing instruction" appears and reappears in discussions, interviews and in classroom action. The core meaning seems to be "What can I do with/to/for each individual pupil to help him/her learn." There is high congruence between espoused theory and theory in use in most classrooms. If individualizing instruction is the intermediate goal, teacher autonomy on how to get there is a major means. Few beginning teachers have entered the system in recent years. Most have gone through a three-tiered hiring process--paper credentials, intensive interviews, and observations of teaching. Teachers were/are hired because they have a point of view and demonstrated skill with the children.

A second belief which appears in the discussions with many of the staff is that of professional responsibility. The core meaning is wanting to be judged for actions which s/he took based upon his/her analysis of an educational problem and situation, and in which s/he made his/her best decision. The clearest accounts of this position came in discussions with teachers as they talked of the reasons they elected to teach in the district. Usually they contrasted Alte with the larger, multi-leveled, bureaucratic systems from which they had come. Usually also they commented about interpersonal contacts in P.T.A. meetings and parent conferences as test cases for accountibility in this kind of professional responsibility. From an administrative perspective this phenomenon is usually voiced as, "'District policy' has been to hire the 'best' teachers and give them freedom to develop their programs."

A third related, and more implicit factor, at least in conversations and interviews, is the "friendly competition" among the elementary schools: that is, within the small group of elementary principals, and, in turn, between the staffs of the elementary schools. The competition seems related to the development of a "building identity" and a favorable reputation among the immediate patrons and across the small district itself. The summary observation notes picked this up in an early discussion:

> As they talked it seemed to come out that different schools had different things going for them(as I'd heard previously). For example--one has a big outdoor education program, second grade and up, overnight camping, etc. Another is trying out some of the new CEMREL math materials in the primary grades, and so forth.

Immediately, upon these notes came the interpretive aside:

> (Obs - All this suggests aspects of the old elementary principals' competition, identity, and place in the sun as a major issue in the dynamics of a district and efforts in curriculum, teaching, parents, etc.)

The identities engage the parents and children and are manifested in such diverse phenomena as spring festivals, flower and garden sales, and picnics. Woe to the principal and teachers who fail to perceive, to involve themselves, and to support such functions.[8] Within the buildings, the competition and identity issues flow into such diverse avenues as open space ("the big room" where a wall has been torn down), team teaching, reification of self-contained classrooms, elaboration of an outdoor education program, or, for our purposes, curricular and organizational change in the form of IPI and an LRC.

The Story of IPI and LRC's

The story of IPI and the LRC's is really a story of the confluence of several interrelated strands of development. First and foremost, some ten years ago, in one of the elementary schools, the principal and several of his teachers remained dissatisfied with what was being accomplished in mathematics instruction. The district program was a mix of innovative projects--Madison math, University of Illinois math, and SRA; the mathematics curriculum committee was moving toward adoption of the Addison Wesley texts. Their own concern was on problems of "individualizing instruction." As class size in their school was declining, the individual non-achieving pupils were less likely to "get lost" in the crowd. The staff, in coping with this, tried several approaches.

A modified "Joplin plan," shuffling the kids from all the primary grades into ability groups for part of the day, was tried. It foundered in part on the mix of dull third graders and bright first graders at the "same" level of achievement. Later, the teachers moved toward developing individualized teaching materials by cutting up old work books by topic and process, collecting scattered materials from their individual files, and gathering games and manipulative materials. The need arose for some kind of centralized space and storage.

Meanwhile, attempts were underway to develop a central library in the school. Initial steps were to open a room at noon. This raised problems with lunch duty, resources, and staff. "A lousy way to run a library," as one staff member commented. Proposals were made to the superintendent for one of the teachers to take on the task full time (in several schools), for a kindergarten room to be converted, and for parent volunteers to be solicited.

About this time a new assistant superintendent for curriculum was hired.[9] His charge was K-12. He was looking for points of entry into the system. He found this elementary staff congenial and joined forces. He brought knowledge of the activities at the

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[8] A number of stories exist of the politics of the individual schools and the district, but they are beyond our interest here.

[9] Again, our data are limited; the reasoning of the then encumbent superintendent, now gone, is not known.

Pittsburgh R & D Center and the Philadelphia Lab, RBS (Research for Better Schools). One of their major programs was an instructional system in mathematics entitled IPI, Individually Prescribed Instruction. Several teachers and the principal visited the demonstration school in Pennsylvania. They were struck with the similarities between what they saw and what they were trying to do. They argued for giving it a try in their school. The board agreed.

To work well, the IPI system requires something akin to a learning resource center. The Alte Elementary School LRC evolved several steps farther. In time it became a facility close to that in Figure 4. Briefly, we would note the LRC contains: a storage area for the hundreds of work sheets in the IPI program; instructional aides who check materials done by pupils, keep records, and dispense materials prescribed by the teachers; school-wide library resource (5,000-10,000 books in each elementary school library);[10] and aides and volunteers who help out in this part of the center. In visits to the LRC's, it was not uncommon to find a half dozen adults busy with children at any one time. The facility seemed to take on a life of its own; that is, its existence and the presence of creative teachers and district resources provoked a series of alterations, additions, and elaborations. As audio-visual equipment was centralized, new programs in literature, e.g., tapes of stories, were developed. Listening and study carrels were added with tape players and earphones. Possibilities in spelling were seen and the Alte individualized spelling program was developed. Special reading teachers, working with individuals and small groups, found a home and became an active part of the LRC. As several staff members commented:

Insert Figure 4 about here

> Housing is a very limited concept and many LRC's are not functional because they become central locations for materials when they should become central locations for learning activities.

The IPI program is well described elsewhere in multiple books, brochures and research reports emanating from the Pittsburgh Learning Research and Development Center, the Regional Laboratory, Research for Better Schools, Inc. (both funded by the National Institute for Education) and Appleton Century Crofts, Inc., the private publisher of the materials. Consequently, only a few brief remarks will be made here; mostly they are excerpts from several hours spent one morning in the LRC with the IPI program.

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[10] Later we will raise the issue of resources, a key aspect of the Alte School District.

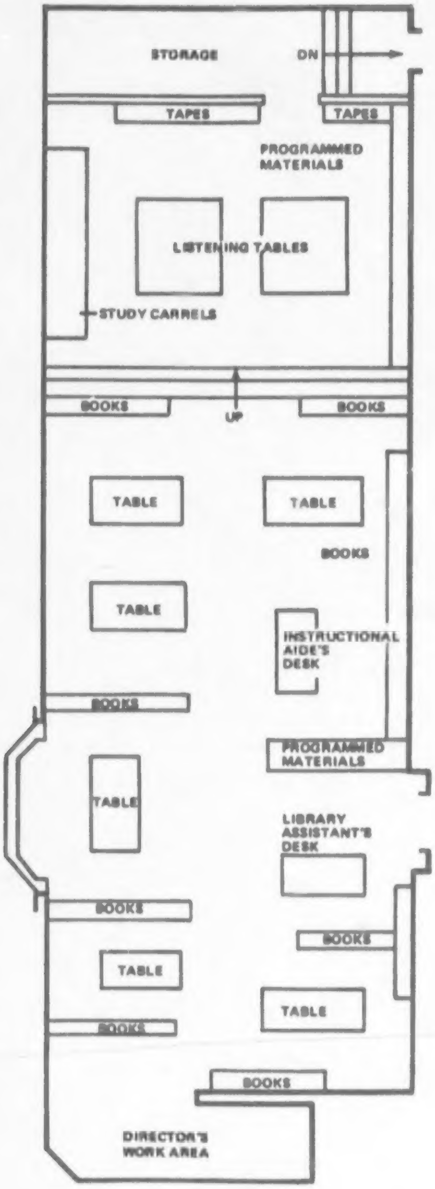
STORAGE
DN
TAPES
TAPES
PROGRAMMED MATERIALS
LISTENING TABLES
STUDY CARRELS
BOOKS
UP
BOOKS
TABLE
TABLE
BOOKS
TABLE
INSTRUCTIONAL AIDE'S DESK
BOOKS
PROGRAMMED MATERIALS
TABLE
LIBRARY ASSISTANT'S DESK
BOOKS
BOOKS
TABLE
TABLE
BOOKS
BOOKS
DIRECTOR'S WORK AREA

Figure 4. Alte Elementary School LRC.

8:47 Am in the LRC. Fourth, fifth, and sixth grades, in turn, this a.m. Two aides handle kids, grading and dispersing work sheets in IPI. Children in and out--four or five so far. Each has a bright blue folder with materials. The aide, at my request, explains the system roughly:

1. a yellow sheet of Areas (numeration, add/subt, mult, etc.) and Levels A-G (roughly grades 1-6); Figure 5 reproduces this.

Insert Figure 5 about here

---

2. Initial placement tests
3. Exercises
4. CET's (Curriculum Embedded Tests)
5. Mastery Tests

The flow of traffic is slow enough that no one stands long in line waiting. Kids bring folders to whichever of two teachers is free. Gals grade while kids wait. Show them if there are errors. Kids correct. With current boy at least two major hints.

(Obs- Through all this I'm reminded of Brueckner's Diagnostic Tests in Arithmetic. The system seems a logical outgrowth of that point of view. Need to look at old NSSE Yearbook from 1934 (?) and the Bond and Brueckner *Diagnosis and Treatment of Learning Difficulties*. Need to check manuals. Seems like a teaching and organizational system (aides, storage and LRC) building upon that. Need to look at IPI manuals and reference literature.)

I go through Placement Test C. There are two or three pages on each area. It does look like Brueckner writ large.

9:33 The aide asks if I can follow. I take that as an invitation and go over as she corrects a couple of papers.

1. They score and record; she handles mostly exercises; the other aide the tests.
2. Have booklets of answers (keys).
3. Kids must correct and see teachers for help and clearance.
4. If kids ask re their mistake they will indicate--especially re silly mistakes. "Teachers don't mind. We're not supposed to teach the children." (Obs - Apparently they handle the issues in a commonsense, reasonably deferent manner. These two gals seem bright and knowledgeable.) "Feel stupid if you don't answer a child's question."

3-18

Name: ____________

Grade: ____________

AREA	A	B	C	D	E	F	G
Numeration/ Place Value	Part 1 Part 2		Part 1 Part 2				
Addition/ Subtraction	Part 1 Part 2	Part 1 Part 2	Part 1 Part 2				
Multiplication	▨						
Division	▨						
Fractions					Part 1 Part 2		
Money					▨	▨	▨
Time							▨
Systems of Measurements	▨						
Geometry	▨						
Applications	▨						

Figure 5. Yellow Sheet representing IPI Scope and Sequence Summary

A formal explication of the more generalized LRC procedures is reproduced as Figure 6.

Insert Figure 6 about here

This figure is used by the staff to explain the general teaching strategy of the LRC, a part of which is the IPI program.

The field notes of the morning continue. They capture more of the flavor of the system and the possible slippage between the ideal and the real.

10:00 The flow continues in and out. I talk some more with the aide.

1. The individuality of kids--attitudes, temperament, "con games" (Can my teacher ok this?)--continues.
2. Most of the grade X[11] kids, as I look at a roomful of summary sheets, are in Level X materials. A few scattered down and up. One kid tested out of all Level X materials and has done only two booklets all year. To my incredulous response, the aide indicates that the youngster works very slowly, the section she's on is difficult," lots of problems and kids get hung up, teacher would never let her just sit." Finally she agreed it seems strange.
3. Kids are only on IPI three days a week.
4. I haven't seen any great antipathy to the materials. Kids seem to enjoy walking and moving around. Some clowning of kids with each other--swatting and brushing each other with the bright blue folders. Seem to enjoy the aides who are calm, in good spirits, helpful, quick and efficient. Kids lean on the aides' desks, sit on a nearby table, chat while they wait, etc. (Obs - somehow the personality, the approach and the skill of the aides seems very critical.)
5. Kids are in and out of the shelves, and in some instances the file cabinets, for materials.
6. The file cabinets contain, among other things, partial booklets--left over pages for kids who only need a section or two.

Later in the same morning, the notes picked up another strand of data, documents about the program, and initial interpretations by the observer. These, too, are presented verbatim:

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[11] Once again, the coding is for anonymity.

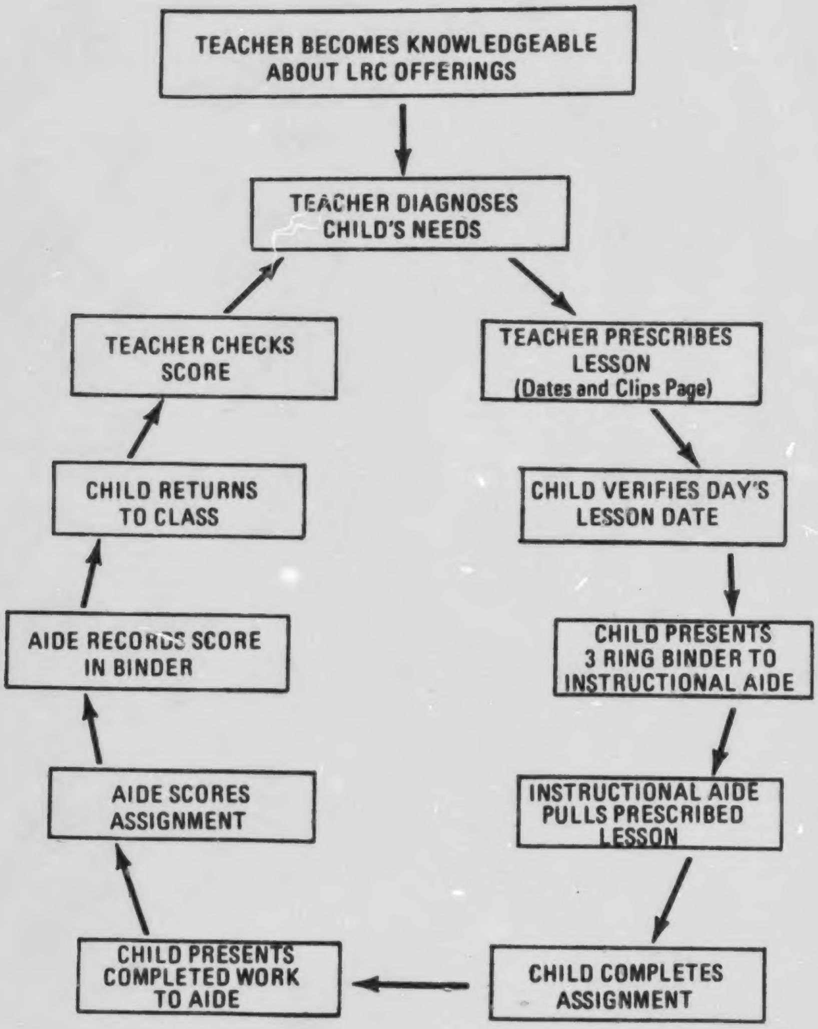
TEACHER BECOMES KNOWLEDGEABLE ABOUT LRC OFFERINGS
TEACHER DIAGNOSES CHILD'S NEEDS
TEACHER PRESCRIBES LESSON (Dates and Clips Page)
CHILD VERIFIES DAY'S LESSON DATE
CHILD PRESENTS 3 RING BINDER TO INSTRUCTIONAL AIDE
INSTRUCTIONAL AIDE PULLS PRESCRIBED LESSON
CHILD COMPLETES ASSIGNMENT
CHILD PRESENTS COMPLETED WORK TO AIDE
AIDE SCORES ASSIGNMENT
AIDE RECORDS SCORE IN BINDER
CHILD RETURNS TO CLASS
TEACHER CHECKS SCORE

Figure 6. Organizational and instructional strategies in using IPI and LRC

11:13 I'm now working my way through

1. IPI Continuum Chart
2. Vol. I Diagnosing and Prescribing for Individualized Instruction
3. Vol. II Managing Individualized Instruction

The IPI Mathematics Continuum is a scope and sequence chart. The aide read the early editions when she first started but not the most recent [third?] revision. She doesn't know whether the kids finishing it should be ready for algebra. The strands seem a hodge-podge of traditional arithmetic skills, common knowledge (money and time), systems of measurements (English and metric), geometry (angles, cylinders and circles), word problems (reasoning ?). On the surface I don't see any "ultimate logic or structure of math" but then I might not recognize it even if it were there.

This review then triggered an even broader set of speculations by the observer.

(Obs - Am struck with the general developmental issue of all kinds of knowledge, much reinforced in the home--cups/pints/quarts/gallons, etc. which one would also get in reading recipes, and other hobby type activities.)

I quiz her (the aide) about homework. No IPI work goes home. It's all done at school. She assumes it's school policy. Any homework would be other activities.

(Obs - Wonder how concerned parents monitor the system and insure kids' success? That would be another latent function of text, homework assignments, and monitoring, helping, encouraging, punishing, controlling kids' behavior. Part of socioeconomic status correlates in conjunction with general ability difference. Contrast with Washington School.[12] Best local evidence on the sixth grade parents' reactions at the meeting on transition to junior high is the P.T.A. meeting at the Washington School. The Alte parents are more knowledgeable, more education oriented, more sophisticated re education [Ph.D.'s, M.D.'s, college education] and channels

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[12] Scattered through this report are references to our earlier study of an urban slum school (Smith and Geoffrey 1968). Perplexities from there have been with us for a decade. New data and images are constantly being compared and contrasted.

> for achievement and "getting ahead," more demanding for school performance besides "be there, on time, do work."
>
> I think what I'm reaching for is a set of reasonably simple hypotheses [mechanisms] on the antecedents, nature and conception of school learning with particular emphasis on explaining the high achievement levels of upper middle class kids, e.g., the two grade levels and/or 1+ SD above the mean on test scores.)

11:47 I'm running out of time. Quickly scan IPI books and manuals.

1. No reference to any professional literature in them
2. As though it sprang up new out of only very general tradition
3. (Obs - Even "how to" books, which these are, should have some sources skeptical people can go to.)
4. Books are quite clear re steps, procedures, mechanics
5. Several spots have been red inked (for and by aides?) re flow of materials

And just before leaving, the observer made a final concluding interpretation.

> I'm amazed/struck by the seemingly flawless aspect of the system here. The aide has been with the program several years. She has no problem, works very rapidly, etc. At this end, the personnel, the facilities, the storage of materials, the plenitudes (nothing looks like it's even close to being out), the routines are all running smoothly. Need to look at other end.

Over coffee, the observer talked independently with several teachers. The notes contain several diverse but relevant pieces for the analysis.

1. She's pro IPI, relieves the teacher of routine work, time to do more interesting things with the kids.
2. Most of this school are pro, most at school B are anti, others up and down.
   (Obs - There's a funny quality re schools--principals, teachers, relationships. Don't really know as yet.)
3. She says she tends to spend remaining time following along (loosely?) a text with supplemental materials.

> (Obs - I get the feeling of multiple ways to skin the proverbial educational cat. Alte has huge array of resources, experienced teachers, able kids, low teacher-pupil ratios. Groups [schools] develop norms re how things should be done, what is good and bad, important and not, and are able to argue quite tenaciously.)

And, in regard to another teacher conversation:

> She has some reservations. Most of the teachers are supportive of the program. Her reservations include: (1) need group activities; (2) need togetherness versus going in fifty directions; (3) need more problems and practice than booklets provide.
> (Obs - Very complicated mix of values (togetherness) beliefs: ways of organizing the class (grouping) and what it takes to learn certain things.)

The Epilogue

The IPI program remains as one of the most controversial programs in the district. The essence of the epilogue is that the story isn't finished. Several items might be mentioned. The program did not spring into full bloom in the form we have recounted. It was tried for a year or two in the initial school. Presentations were made to the board, discussions were entertained, and the decision was made to implement it in all of Alte's elementary schools. From that point on, the road has been more stormy. In the eyes of one teacher, "It was forced on the rest of the district by the assistant superintendent."

The program has been in considerable contention since then. Some parents have been very dissatisfied. Local test scores in math were reported to be lower. Several years ago an independent assessment of the curriculum was commissioned by the board and carried out by a local firm of evaluation consultants. They reported favorably on the program and recommended that IPI be retained as the core of the mathematics program.

Math teachers at the junior and senior high school in general look with disfavor upon the program. When the board moved recently to have the elementary math program to be half IPI and half teacher developed curriculum, one of the teachers commented, "We've got the battle half won. It'll be totally won when IPI is completely gone."

The LRC's have fared better, in the sense of less conflict. They've developed somewhat differently in each school, but each provides a wealth of resources and activities to supplement the teacher in her classroom.

As an illustration of curriculum change and transformation in Alte, the IPI and LRC stories present several lessons: teacher autonomy and professionalism, administrative influence, competing groups, conflicting points of views, multiple kinds of evidence, and a never-ending process with moments of quasi-stationary equilibria. That this is not atypical of the district can be seen in our current observation, e.g., the beginnings of the CEMREL's new math with its "mini-computers" in the primary grades of one of the Alte Elementary Schools. Our interviews and observations of outdoor education, of which we'll say more later, present another instance. And so on.

To determine how similar or different Alte is from other districts requires other data. Presumably other case studies will illuminate these comparisons and contrasts. Analytically, syntheses of antecedents and consequence in additional cases and from historical and contemporaneous accounts will move toward more general models, paradigms, and theories. That is not our task here.

Organizational Structures for Coping with Curriculum: A Final Observation and Comment

The discussion of the history of the district and the items of recent change provide one perspective on science education in the Alte Schools. Another point of view arises in considering organizational structures for "coping with curriculum." The verb "cope" is deliberately chosen as a label for a broad set of issues (e.g., develop change, implement, integrate) involving "struggling or contending with some success." Alte has these mechanisms in place.

1. The school board reserves one meeting per month for discussion and review of curriculum. Areas are taken in rotation and/or as need arises.

2. Each major elementary curriculum area (language arts, math, science and social studies) is represented by a committee of teachers, chaired by an elementary principal. Chairmanships are rotated and allocated by choice, interest, and competence.

3. Each area of the grade 7-12 program is headed by a curriculum co-ordinator, often, but not always the chairman of the relevant high school department. The co-ordinators teach a full load during the year and work the equivalent of an extra month in the summer and weekends.

4. The curriculum chairman and co-ordinators meet once a month.

5. Over the years, resources have been available for summer curriculum work by teams of teachers and administrators.

6. Each principal is responsible for the program in his/her building.

7. Each teacher is responsible for the program in his/her classroom.

What the structures were in the past is not clear. Each superintendent seems to have developed his own arrangements. District files of curriculum committee reports go back only to the late 1950s. Whether this is a function of no earlier curriculum work or lack of historical data is not clear. Other records and interviews indicate that in the recent past there have been assistant superintendents for curriculum and these individuals played influential but controversial roles in the district.

A further aspect of the system's organizational structure is the rotational review of principals. One or two are "up" each year which means the district review cycles everyone every four or five years. This has both a formative and summative aspect.[13] In regard to the former, discussions are held, mutual agreements are reached on self-improvement goals--for instance, science or social studies curriculum improvement in the school. Procedural steps are laid out in terms of introduction of ideas and materials, individualized work with specific teachers, and so forth. Early on in the course of one such discussion the observer made a brief interpretive aside:

> (Obs - Again a possible point of departure for analysis. How does a school bootstrap itself?)

With the accumulation of further data, such formative evaluation procedures seem to elaborate aspects of the district's coping with curriculum.

Several important generalizations seem to stand out from this analysis. First and perhaps foremost is the tension or dilemma between the bureaucratic/organizational tendencies and the individual/professional tendencies. On the one hand the organization is continually striving for rationality--agreed upon goals and priorities, clarity of procedures and organizational mechanisms, responsible supervision. That is, there are committees with domains of activity and chairmen responsible for their functioning. On the other hand, as we will present in detail later, there are highly trained, competent professionals in schools and classrooms who are selected, hired, and expected to know what to do in their own domains, to choose and decide intelligently and responsibly, and who exercise and enjoy their autonomy. As we have indicated, the dilemma is really a "tri-lemma" in that political forces operating through citizen accolades and complaints to the board are part and parcel of the overall coping process.

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[13] We obtained little data on the summative evaluation aspects, an issue beyond the scope of this investigation. Suffice it to say there has been considerable turnover of principals in the district over the last dozen years.

If all this be true, and our data and analysis would so argue, then an agency such as NSF, or a national curriculum project, or a university department or school of education engaged in teacher education is faced with a kind of reality not usually described in the educational change and innovation literature. The local district arrangements in curriculum and teaching--science education, if you like--are not happenstance, not chance, nor accidents, but the resolutions of individual choices, contending points of view, and differential power. NSF (and the other outside groups) becomes a fourth category of contestants with its own resources and rewards, its own point of view with all the internal consistencies and inconsistencies, its own skill in persuasion and influence. The social processes continue.

CONCEPTUALIZING A DISTRICT WIDE SCIENCE CURRICULUM

Introduction

Initially, and tentatively, we can define curriculum as "...a programme or course of activities which is explicitly organized as the means whereby pupils may obtain the desired objective..." (Hirst and Peters 1970, p. 60). Even a superficial unpacking of such a definition indicates the theoretical complexities and the empirical quagmire in the conception. The essential difficulties lie in the constraints provoked by intentions and plans of some agent implied in the phrase "explicitly organized" and in the constraints provoked by the pupil learning outcomes implied in "desired objective." In effect, curriculum, by definition contains a three step proposition:

intentions ⟶ activities ⟶ attaining desired outcome

Further complications arise, as our preceding analysis of the Transformation of the Alte School District suggested, for there are several clusters of actors with intentions--board, administration, teachers, children, and parents. In general, in Alte, the intentions of these groups are congruent.

There are a number of ways one might cut into the phenomenon of curriculum. As one teacher said, "Science education may be defined by NSF as math, science, and social studies, but no one in the Alte Schools sees it that way." In Alte High School, for instance, the administration, the teachers, and the students see three separate departments--math, science, and history. That separation exists. The departments meet as departments, plan curriculum, decide (in part) who teaches what courses, what new offerings might be tried and so on. The courses tend not to be interdependent across disciplines. This is what we have come to speak of as "formal curriculum." Beyond an analysis into these domains of math, science, and social studies, the overall program seems amenable to an analysis in terms of dimensions, aspects that cut through the program. The most significant of these will be sketched out in some detail.

Formal curriculum reflects only a part of what is happening in the Alte Schools in science education. We kept "bumping into" a number of "special events" which were occurring during the semester, which were referred to or which had left products from the past. They consumed considerable amounts of time and energy of staff and students. They seemed relevant to important educational goals. They tended to cut across disciplines. This we have called "informal curriculum: degree of enrichment." The two major instances which will be analyzed are a community history project carried out by the junior high pupils and the outdoor education program implemented at all levels of the district.

Finally, a category of events, almost a latent curriculum in itself, is what we have called "curriculum or what is taught: vignettes of teaching." In effect the rubrics of formal and informal curriculum miss a major element of the Alte District's program, the "individual teacher with his idiosyncratic style." Alte prides itself on its "good" or "strong" teachers. "Living legends" might be an even more apt title. To miss this is to miss what many would see as the core element of science education in the district, or education more generally in the district.

In addition, the fact that there are separate elementary, junior, and senior high schools creates some obvious but nonetheless important distinctions. The buildings are geographically separate. By law, the elementary and secondary training programs in which the teachers have been educated are different. The organizational arrangements, departmentalization vs. self contained classes, vs. open space and some teaming, are different. Such environmental events lead, quite naturally, to each building (and each department in the high school) developing its own social system--activities, pattern of interactions, beliefs, sentiments, points of view and norms. To a degree, there is differentiation within the overall district.

Formal Curriculum: Science, Math, Social Studies

The unit of analysis of the curriculum in the day to day functioning of pupils, teachers, administrators, and accrediting agencies is "the course." The day of a pupil and the career of a pupil can be tracked through the courses s/he takes. Similarly, teacher work loads, daily schedules, and responsibilities are tied intimately with "the courses" s/he teaches. Consequently, we present, initially, the patterns of courses offered in math, science, and social studies. Then we will look to regularities and aspects of the course structure by which we can talk of differences across districts. Later we will raise complications arising from an analysis of science education based solely on course labels and descriptions.

Elementary School

In the elementary school, particularly in the primary grades, everyone we talked to accented the fact that reading was *the* subject taught and learned. Time, effort, and much of the extra resources (reading teachers, libraries, and materials centers) focused on reading. Parent expectations, elementary teachers' backgrounds and credentials, pupil activities are congruent. Administrators commented softly--"The reading problem is licked. There aren't a half dozen children in the eighth grade in the junior high who read at less than sixth grade level."

With that as backdrop, the most important fact about science, math, and social studies in the elementary schools is that the program is "half discretionary" with the individual teacher. In science the ESS experiments are half the program and a variety of activities make up the other half. In math, the program is half IPI. Social studies is the most varied and has been changing within the last few years. Previously, a list of concepts, ordered by grade level, made up half the program. Recently, the Databank program has been selected as the major curriculum vehicle. Considerable variability exists across schools. Figure 7 presents the range of activities.

Insert Figure 7 about here

In the last few years, various committees and subcommittees of teachers have been working toward a perspective on social studies curriculum. In one of these reports, a committee of teachers representing each of the elementary schools in the district made a series of recommendations. In their prefatory remarks they stated

> The members of the Social Studies Committee agree that the following components and teaching strategies listed here are desirable in a social studies program.

In Figure 8, we present the items from that report. As we read it the content is a mix of knowledge, intellectual skills, value learning and social development. Social studies is seen as a vehicle

Insert Figure 8 about here

for more general development of the classroom as a unit into a cooperative working group. Further, in the report, each of the curriculum possibilities listed in Figure 7 was cross referenced by number and letter as the components and teaching strategies were involved.

In a later report, authored by an administrator/chairman, the Databank system is described (along with several other curricula) in some detail.

> At each level the Holt Databank System is made up of three basic components.
>
> A textbook focuses the problem for study with data which include a full range of visuals: museum reproductions, cartoons, maps, line drawings, and paintings.
>
> The information storage-retrieval unit, the databank, houses a complex media mix of both print and non print materials (called a Data box at K-2 levels). Filmstrips, data cards, LP recordings, data foldouts, data packs, games, simulations, and data masters are included.

Science	*ESS* (50% of program) Science Projects Sixth Grade Camp Texts Other Experiences
Social Science	*Holt Databank* (50% of program) MACOS Allyn and Bacon: *Concepts and Inquiry* Laidlaw Social Science DUSO: *Developing Understanding of Self and Others* Human Development Program Other Experiences
Mathematics	IPI (50% of program) CSMP Textbooks Other Experiences

Figure 7. Elementary Program (1977): Science, Math, and Social Studies

ESSENTIAL COMPONENTS: ELEMENTS THAT SHOULD BE PRESENT IN ALL SOCIAL STUDIES PROGRAMS.

1. Concept-oriented rather than fact memorization.
2. Multi-disciplinary, multi-media approach.
3. Geographic concepts and skills included at all levels.
4. Research and data processing skills included at all levels.
5. Development of critical thinking included at all levels.
6. Value identification and clarification (personal and social).
7. Includes learning how to live and operate as an individual and with a group.
8. Content provides opportunities for the application of knowledge, skills, values.

TEACHING STRATEGIES.

A. Social Studies should often be the unifying theme for class activities.
B. Emphasis should be on inquiry, discovery, or inductive procedures rather than expository methods.
C. There should be an element of novelty or vividness.
D. In-depth studies rather than survey studies are preferable.
E. Varied activities and resources should be used.
F. The emphasis should be on group activities with some provision for individual interests.
G. Sometimes goals established through teacher-pupil planning are preferable to teacher selected goals.

Figure 8. Social Studies Principles: Curriculum Committee Perspective

> A teacher's guide explains how the entire Holt Databank System works, provides background material, gives unit-by-unit objectives, and provides day-by-day lesson plans.
>
> The textbooks differ from the textbooks with which most teachers are familiar. They do not function as "close-ended" terminal resources--used solely for their own sake. Instead, they are created to function cooperatively within the Databank System.

Finally, the program in each of the elementary schools is described. The within school variations (from grade level to grade level) and the between school variations suggest the complexity of Alte's Social Studies program. In the committee chairman's words:

> As can be seen by comparison of the Social Studies Committee's Chart and School A's Chart, that school is using throughout, one of the recommended programs at every grade level [Allyn and Bacon: Kgn, 1; Holt: 2, 3, 4, 6; MACOS; 5]. There appears to be no problem in organization or sequencing.

And

> School B uses four sets of materials. Kindergarteners start with Holt Databank. First graders use the Laidlaw social science program. Allyn and Bacon is used in 2nd, and 3rd grades. Fourth grade is a return to Databank, MACOS is used in the 5th grade, and Databank again reappears in the 6th grade.
>
> While the approach is eclectic, the topics which appear in the various programs are similar to what would occur as the child proceeded through school were a single program being used K-6.

The later report comments on the earlier committee's work:

> At no point in their deliberations did the members of the Elementary Social Studies Committee attend to the concept of statistical data as having relevance in determining what the Alte District's social studies curriculum should be.
>
> The question of how students score on standardized tests cannot, however, be ignored, and the following pages contain information on that count.

There follow a half dozen pages of data from the Stanford Achievement Test. One statistic summarizes the results--the median of pupil scores is in the interval between the 81st and 85th percentile on national norms.

Among the report's conclusions, two bear upon the issues of curriculum.

> Elementary social studies continues to be an area in which we find the least agreement on what we should be doing and the most difficulty in fully implementing.
>
> In general, however, the record of what is being done is dramatically improved over last year's assessment. Then, recommended programs could be found in about one-third of the classrooms in the district. Now, at least one of the recommended programs can be found in three out of every four classrooms. Of course, how well they are being used is a judgment the principal must make. And it cannot be denied that some teachers may be doing an excellent job with other than the recommended programs. It would seem, however, that almost every teacher needs a good set of materials from which to start social studies instruction and it also seems that she should feel free to take off from these materials whenever appropriate.

Careful reading of those paragraphs suggests a number of potent but implicit aspects of curriculum in Alte.

The formal curriculum at the elementary school illustrates vividly one of the most central problems in a theory of education as a theory of action--dilemmas, trade offs, and decisions. In this instance, one might draw extreme cases of a prescribed curriculum for all schools and classes in science, math, and social science on the one hand, and a curriculum totally left to each individual teacher on the other hand.[14] In between steps on such a continuum might be the introduction of some commonality within each individual building, which does occur presently in Alte. Another variation between the extremes is to provide a prescription, as is also now in place in Alte, that half of the math time is IPI and half the science time is ESS.

The logic of the alternatives seems to be an accent on motivation, creativity, and interest on the one hand; and orderly, organized, and sequenced teaching and learning on the other hand. At its best, one is back with the former to the "project" and "activity" curriculums of Kilpatrick and perhaps Bruner. With the latter, at its best, one is back to Herbert and perhaps more recently to Ausubel. Complex aptitude x treatment interactions exist at the teacher level: that is, who can do what with each orientation.

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[14] An even more extreme possibility would be to have the curriculum determined by the children. See Anatomy of Educational Innovation (Smith and Keith 1971) for an account of attempts in this direction.

(Similarly, one assumes broad pupil aptitude X treatment interactions at the pupil level.) The complications that exist with smaller elements in the program (e.g., having a library program or involving the children in special events) and with independent parental concerns and initiatives make the experimental testing of such ideas extremely difficult.[15]

To presage one of our later arguments, and a major position in this monograph, the resolution of curriculum and teaching issues is a "complex valuational/theoretical/empirical judgment." These judgments are determined by individuals and groups in contention. Similarly, the mechanisms, the means, the structures, whether they be textbooks, particular kinds of projects, modes of presentation and interaction are also in contention. The fabric of debate and influence is complicated by ideas, skills, personalities, and reputations of individual teachers, by precedent, by group norms of departments, faculties, P.T.A. bodies, and so forth. Even principals, superintendents, and board members (individually and collectively) seem to have a say.

A market place metaphor fits as one small part of this total process. Teams of "experts" of what ever kind--disciplinary, pedagogical, psychological, organizational, working in National Labs or R & D Centers, or on national or regional curriculum task forces, or in commercial publishing companies, or individually writing texts or units of material-- produce, make available, present their "wares" to the contending groups for their consideration, purchase, and adoption. To see one's carefully crafted creations (MACOS, DUSO, Databank) as "just another set of ideas or materials" may be a blow to one's ego, but it may also be a reality.[16]

Junior High School

Alte Junior High School presents a strong identity as a transition point in the educational lives of its pupils. The obvious physical changes in the youngsters are evident as one walks through the halls. The teachers are different--a minority are former elementary teachers with a "whole child perspective" and a majority are discipline/subject matter-oriented teachers. While a few have "come down" from the high school and a few would like to "go up" to the high school, most are focused (a few aggressively so) on the special problems and possibilities in this transition period. The school organizational structure is a mix of teams and disciplines. Each grade level has two teams composed of four teachers, one each in math, science, social studies, and English, and approximately eighty students. Classes average about twenty children. Teachers teach four fifty-five minute periods and have varied other responsibilities for the remainder of the day. Most have just one or two different preparations, e.g., three sections of eighth-grade math and one of algebra. Except for math, there is no ability grouping. Outside the scope of this investigation are the programs in English, foreign language, P.E., music, art, industrial and domestic arts.

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[15] Some of these problems in research on "effective teaching" are posed in detail in Smith (1977).

[16] The degree to which Alte's reality is a national reality is another question.

Figure 9 orders the science education offerings. In the seventh grade, life science is taught; and in the eighth grade, physical science is the curriculum. At each level the courses are a mix of texts and laboratory experiments. Social science is essentially a two-year history course labeled American studies. The seventh grade pursues a broadly based American culture up to the Civil War; the eighth grade moves from Reconstruction to the present. In science and social studies the children are grouped heterogeneously (in most instances within the teams of eighty pupils). Math provides the first elements of choice among the core subjects. In the seventh grade the groups split into regular math and pre-algebra. In the eighth grade, regular math and algebra are taught.

Insert Figure 9 about here

Alte Senior High School

Alte Senior High School's Curriculum Guide looks like the catalogue of a small college. Earlier, we reported the overall array of courses. In Figures 10, 11, and 12 the curriculum of math, science, and social studies is presented.

Insert Figures 10, 11, 12 about here

Several general comments are in order. In "science education," Alte requires for graduation one unit in math, two units in science, and three units in social science. The curriculum guide has a paragraph of advice regarding course planning and college admission, a statement on "early completion of high school," the "credit/no credit option," the possibilities of an "independent study contract" and "Graduation with Honors," The latter is split into "High Honors" and "Honors." No mention is made of the Alternative High School.

Both math and science seem to break into two levels. One sequence is for students who will pursue science and professional/technical studies (engineering, medicine, architecture) in college

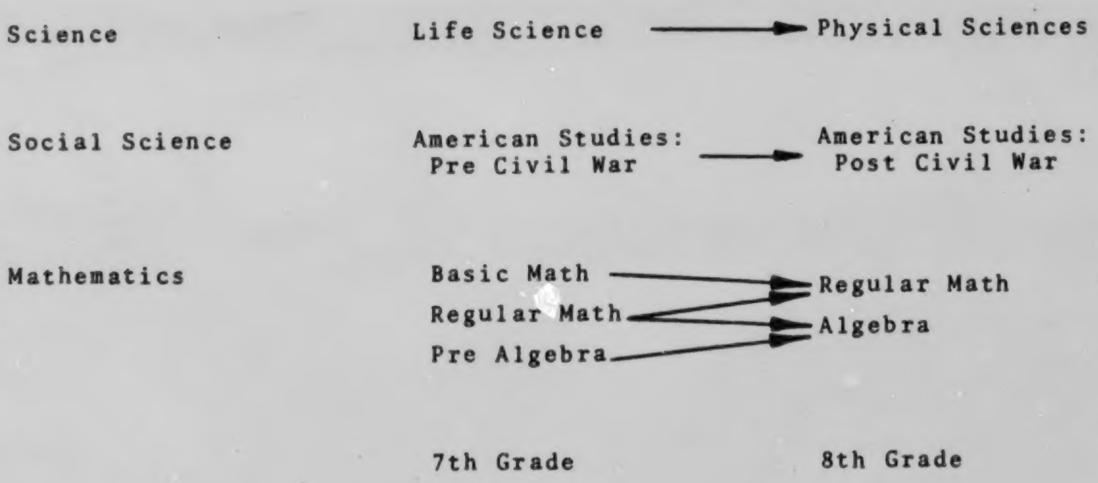
Science
Life Science
Physical Sciences
Social Science
American Studies: Pre Civil War
American Studies: Post Civil War
Mathematics
Basic Math
Regular Math
Pre Algebra
Regular Math
Algebra
7th Grade
8th Grade

Figure 9. Junior High Program: Science, Math, Social Studies

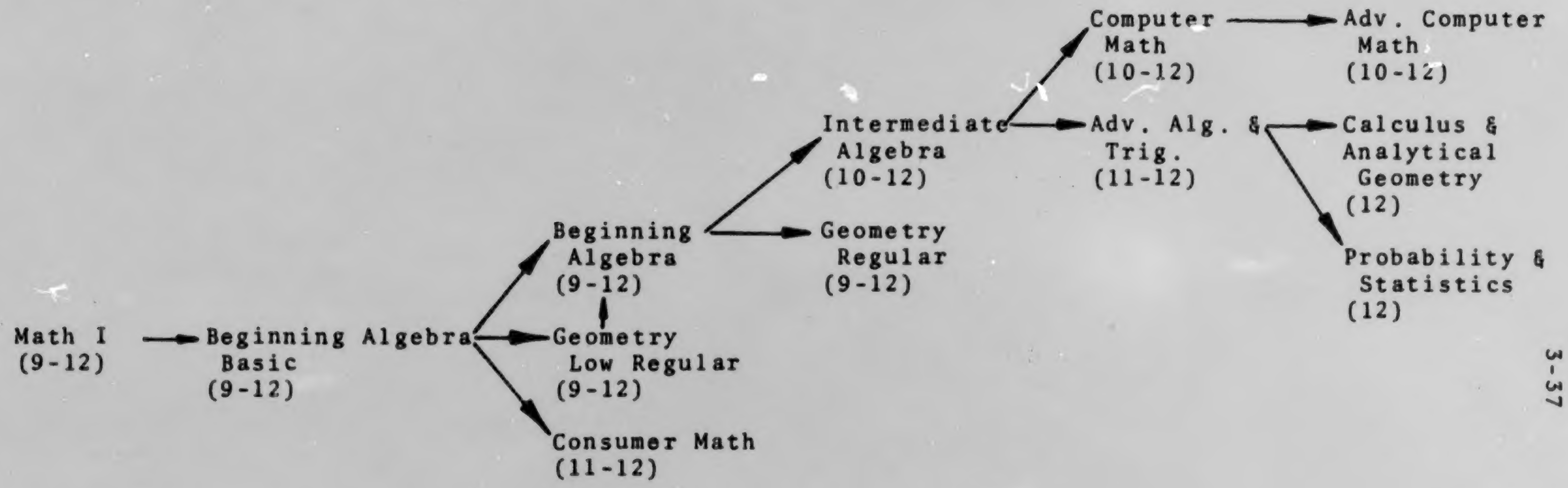
Math I (9-12)
Beginning Algebra Basic (9-12)
Beginning Algebra (9-12)
Geometry Low Regular (9-12)
Consumer Math (11-12)
Intermediate Algebra (10-12)
Geometry Regular (9-12)
Computer Math (10-12)
Adv. Alg. & Trig. (11-12)
Adv. Computer Math (10-12)
Calculus & Analytical Geometry (12)
Probability & Statistics (12)

Figure 10. Alte High School Mathematics Curriculum

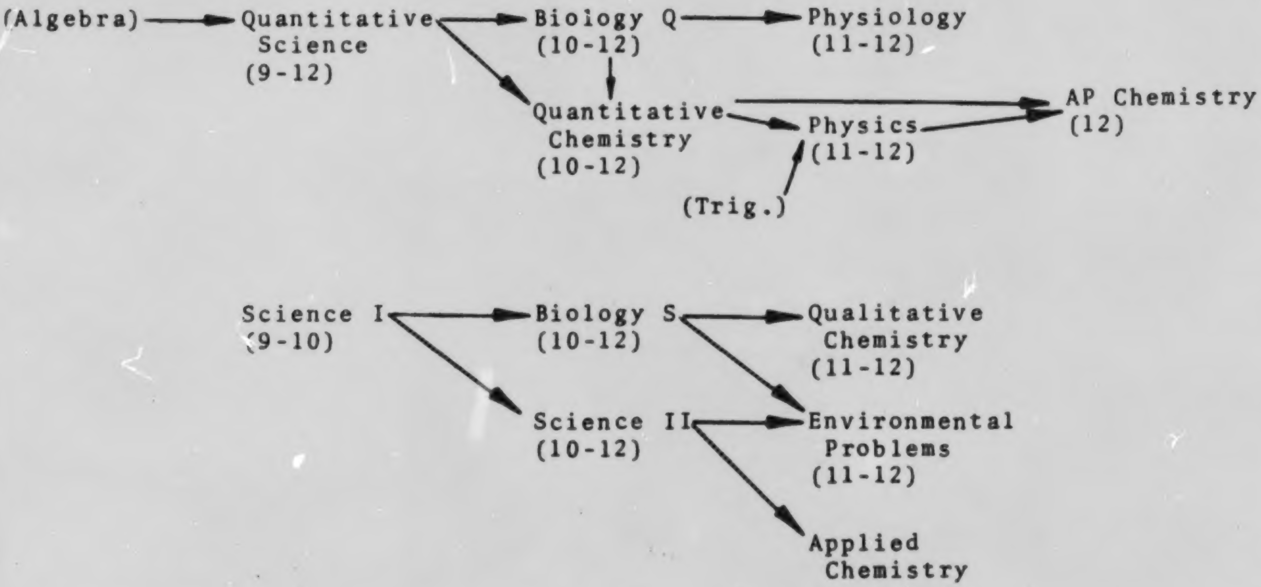
(Algebra)
Quantitative Science (9-12)
Biology Q (10-12)
Physiology (11-12)
Quantitative Chemistry (10-12)
AP Chemistry (12)
Physics (11-12)
(Trig.)
Science I (9-10)
Biology S (10-12)
Qualitative Chemistry (11-12)
Science II (10-12)
Environmental Problems (11-12)
Applied Chemistry

Figure 11. Alte High School Science Curriculum

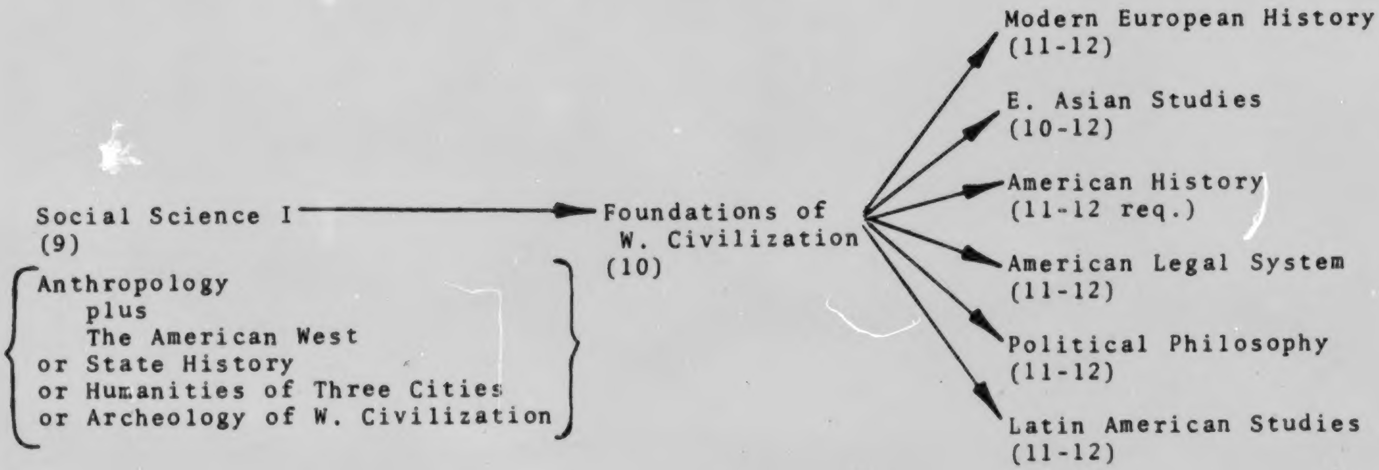
Social Science I
(9)
Anthropology
plus
The American West
or State History
or Humanities of Three Cities
or Archeology of W. Civilization
Foundations of
W. Civilization
(10)
Modern European History
(11-12)
E. Asian Studies
(10-12)
American History
(11-12 req.)
American Legal System
(11-12)
Political Philosophy
(11-12)
Latin American Studies
(11-12)

Figure 12. Alte High School Social Science Curriculum

and professional and graduate schools. The other sequence is for non college-bound students. It is possible to switch back and forth. Many college bound students opt out of the more advanced courses. The social science department is heavily history. Its classes are more heterogeneously organized and with fewer prerequisites.

The most important cross-departmental relationship occurs in ninth grade quantitative science, which requires algebra as a prerequisite (or concurrent registration). Physics requires trigonometry which, in turn, has its own prerequisite in geometry and intermediate algebra. As indicated in the discussion of the Alte Junior High curriculum, students have the option of taking algebra in the eighth grade. This tends to begin tracking those youngsters who will ultimately do the most advanced work in science and math.

Dimensions of Formal Curriculum

Early on, the general foreshadowed problem of how one "talks about science education in a school district" began to fracture into smaller problems. One of these was the issue of dimensions or foci which could be used to compare school districts. In the observer's eyes, one of the prototypes became: "if one had fifty school districts and one wanted to compare and contrast them on their science education programs, what categories, dimensions, or foci would s/he select to do this?" In the analysis of the Alte data, a half dozen seemed critical.

Excellence as a Goal

One can not be around the Alte District very long without running into comments about "academic excellence." As a value, purpose, goal, objective it provides a perspective on the entire system, yet, at the same time, it harbors some interesting implications. It doesn't sound like, carry the usual connotations of, the language of behavioral objectives that the educational psychologists and learning theorists are fond of citing. Nor does it convey the flavor of the MBO, management by objectives, school of thought in educational administration. Rather it seems a mix, a corruption perhaps, of a humanistic stance of "knowledge for its own sake" and "learning as a social mechanism."

Excellence is perhaps most closely defined in science education as increasing specialization of knowledge, a phenomenon we'll attend to in more detail shortly. In effect, the more excellent you are--as teacher or pupil--the more you know about some phenomenon--advanced chemistry, history, history of the British Empire, advanced algebra or calculus. The knowledge is increasingly specialized and technical. It is open ended, a vision of unlimited horizons if you like, in that there is always more physics, more information about Western civilization and more advanced math than anyone can absorb in the first sixteen to eighteen years of one's life.

This quest is tied into a competitive system: How is pupil X doing vis-a-vis pupil Y? Places in good colleges are limited. Admission is by grades and college board scores. These instruments are norm referenced; that is, the derived scores are usually, if not always, a number indicating how you compare with someone else, a standardization group. The children of Alte take frequent tests--and do "well" on them. Anthropologists speak of finding the "apt illustrations"--data supporting and illustrating the general point one wants to make. As the initial draft of this report was being written, the observer received a copy of the Alte Staff Bulletin prepared in the superintendent's office. The two lead articles from late May are presented as Figure 13. The statements complement each other very well.

Insert Figure 13 about here

Grades and teacher recommendations begin to have real impact in the seventh grade--who takes pre algebra. The grades are based on quizzes, tests, papers, and lab reports which are given frequently and which are based on assignments, reading, and lab exercises. Most are recorded--"Does this one count?"--and become part of the teacher's armentarium when youngsters want to know what their grades are or parents complain that they think Johnny or Suzie should be doing better.

Such competition puts a premium on those who have "natural" talent and ability. And Alte has many youngsters with very good minds, many of whom are in evidence from the beginnings of the primary grades. The competition also generates considerable pressure for achievement. Some of the more interesting aspects of this appear in the continuing controversy around the Alternative High School which we examine in more detail later. The issue here is that some of the staff see some of the students opting out. "They can't take the pressure." Others see the implications of the alternative life style as a criticism of the core value of the system, academic excellence, and of the complex of related activities, mechanisms, and procedures which enhance that value.

Finally, one might mention the long involved faculty discussions, report after report of summer curriculum committees, the development of multiple alternative courses, e.g., Science I as well as quantitative science, basic algebra as well as regular algebra, and so forth, as the school district wrestled with the problem over the years. These courses, in turn, play back into the faculty social structure--who teaches them? What are the implications for prestige in the department, in the school, and in the district generally?

ALTE'S READING RESULTS

As we read in the newspapers about the reading difficulties found in the entering college freshman of in school age children, we may wonder about Alte's test results.

The following are the reading results from the January, 1977 Stanford Achievement testing:

	Qtl. 1	Median	Qtl. 3
Grade 1	1.7	2.2	2.8
Grade 2	3.3	4.1	4.9
Grade 3	4.6	5.7	7.4
Grade 4	5.7	7.3	8.9
Grade 5	7.0	8.7	10.4
Grade 6	7.9	9.8	10.6*
Grade 7	9.2	11.0	12.6*

*Top of Test

In first grade an average student should be reading at 1.5 compared to the national norms. Our average student was seven months ahead of the national average.

SUMMER READING PROGRAM

Attached to this issue is our announcement plugging the Metropolitan Library's Summer Reading Program. In a day or two elementary teachers will receive one for every student K-6.

Please urge pupils to participate and to take the sheet home to get parent participation and encouragement.

We have made a special arrangement (Alte is the only District doing this) to start our kids off with their first Official Metropolitan Library Record Card for this summer program. We will have 500 Record Cards, and will get them to each school within the week. To make sure it's impressive, tell your pupils they must personally ask for one from your Reading Teacher or School Librarian if they wish one.

Get them to read this summer--and make the job easier for that poor tired-looking teacher next year. It may be you!

Figure 13. Aspects of Excellence

Degree of Advanced Specialization

This dimension of curriculum refers to the depth, level of difficulty or the degree or amount of advanced specialization possible in the curriculum. At one time a high school which offered four years of high school science--general science, biology, chemistry, and physics or several years of math--algebra, geometry, trigonometry-- had programs of depth or high levels of difficulty (Lee 1928). At Alte High School, as the previous figures indicate, students have options including second year biology (physiology) and advanced placement chemistry, and, in the recent past, A.P. physics. In math, calculus is regularly offered; probability and statistics "is still on the books" but has not been offered in several years. In history, the program branches into area studies, contemporary issues, and political philosophy, each of which can be taken in the junior or senior year.

At the district level the concept of knowledge implied in "degree of advanced specialization" doesn't seem to fit the usual rubrics of a Bloom's Taxonomy. A history teacher who "takes on" the youngsters in hard debate wants his/her students to "stand up and argue him/her (the teacher) down"; that is, to be assertive, critical, knowledgeable about ideas, events, and their interconnections (from the Magna Carta to contemporary student revolt). Similarly, the math teacher who entertains a debate among 1) the advanced algebra problem in the text, 2) the students' problem with the problem, 3) the instructor's view of the text problem and the students' problem, 4) his/her own view of the problem, and finally, 5) the text author's implicit possible views of the problem is "presenting," "struggling with," "illustrating" a very complex view of mathematical knowledge. Finally, the biology instructor who is briefly talking to the kids about some preliminary aspect of meiosis and mitosis and involving them in an extended exercise in chromosome and genetic alterations in cell division while demanding that their thinking and ideas get organized into formal laboratory reports and who, at the same time, is having them observing and recording the final days of various specimens in multiple concentrations of DDT, is stressing a further kind of specialized and technical knowledge.[17]

At a simple level, rating or category scales could be developed to measure the degree of advanced specialization. For instance, in science a district with a high school offering general science and perhaps biology seems different from one offering four years of science, and this, in turn, seems significantly different from one offering two years of biology, chemistry, and physics. As our vignettes of teaching will indicate, the relation of these simple catalogue assessments to the intellectual realities of the classroom becomes, in itself, a major problem. Such measures then could be related to a variety of antecedents (size of school, socio-economic status of the community, training of the staff) and a number of consequences (type of college selected, success in college, advanced placement credits, career choices, etc.). And perhaps most fundamentally to the local district's purposes and goals in the education of their children.

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[17] These illustrations will be presented in greater detail later.

A final comment seems in order regarding the degree of advanced specialization. It seems intimately related to the concept of excellence as a goal and to a major kind of teacher frustration--which will be raised in later discussion of teaching. Teachers in Alte who have taken advanced work in their disciplines, MA, MA+, or Ph.D., frequently are caught in a different conflict. The more able they are, the better trained they are, the more they want to express themselves creatively, the more driven they are to settings--advanced placement courses at Alte, evening and summer college and university appointments where they have contact with more advanced (in age and experience) students. Further, they are drawn to laboratories and sabbaticals where they can do their own research and writing. One of the observer's "surprises" was the number of poignant conversations among individuals he had not known before, in which the depth of concern, the frustration, the inevitable and unremitting conflict posed by these elements was raised.

Breadth of Curriculum

Breadth of curriculum refers to its scope or variety of courses. At its most primitive level, it can be seen in the initial three offerings when Alte High School began--Latin, English, and algebra. By 1911 there were twenty-three units offered. Today, Alte High School is referred to by some of its staff as "Alte University" reflecting the breadth and scope of its offerings (as well as the degree of advanced specialization). In the 1976-77 Curriculum Guide, eighty-one units of credit are offered. A student taking five units per year would require a decade and a half to take the whole high school program. As has been indicated, some dozen courses are available in each of the three areas of science education.

"Breadth of curriculum" has its own problems as a scale, for it conceals or at least implies a fundamental conception of a domain of knowledge. This is seen most clearly, perhaps, in social studies. Consider two definitions--conceptions--of social studies.

#1: social studies as history
#2: social studies as empirical and historical social science

In terms of the first conception, Alte has a high degree of breadth of curriculum--American civilization (past and present), Western civilization, Asian studies, Latin American studies. For some students, the American West, state history and the humanities of three cities--Athens, Florence, and New York--is part of the curriculum. The student who concentrates in social science comes away with a breadth of knowledge (as well as depth) about the history of mankind, a far cry from a little civics, a little American history and a little European history.

By the same token, if definition #2 is taken, the youngster has little conception of laboratory psychology,[18] quantitative sociology, and economics or contemporary political science. Anthropology and some archeology are part of Social Science I and generally fit an historical perspective.

This is not to argue either conception as "better or poorer," nor to examine the tradeoffs, nor even to look to the antecedents (e.g., "We're a small school and can't do everything," versus hiring policies in the last decade). Rather, it is to suggest that breadth of curriculum seems an important dimension of a school, that measuring breadth is not as simple as one might first suppose, and that underlying such a dimension are important conceptual and definitional positions.

Degree of Interrelatedness/Connectedness/Integration[19]

This dimension is really several dimensions. Teasing them apart has been a difficult problem. Listing them suggests the complexities:

1. articulation--connectedness from ele[illegible] junior to senior high,
2. within disciplinary/departmental connectedness, and
3. cross disciplinary departmental connectedness.

Each of these represents a story in itself.

The degree of articulation is a "2 X 3" problem--elementary to junior high and junior to senior high school on the one hand, and the three curricula on the other. Conceptually, math is perhaps the most logically interrelated. General arithmetic concepts and processes blend into pre-algebra and algebra in the junior high, and this leads easily into the varied breadth and more difficult courses of the senior high school. However, the controversy over IPI, as we have indicated, runs through the system. Latent in the criticism is more a rejection of the instructional system than of the content per se--which is reasonably traditional. The teachers at the junior and senior high do not like the individualized workbook, minimization of the teachers' instructional role, and elimination of the class as a working teaching/learning group. In this sense articulation becomes not only conceptual/substantive articulation, but instructional articulation.

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[18] As indicated elsewhere, psychology is listed in the category of "Other Courses" along with community service, drivers education, and a counseling mini course.

[19] At one point, Bernstein's (1971) concept of classification seemed to reflect what we were reaching for. His more taxonomic and categorical mode of thought seemed to run cross-grain with ours. An examination and integration awaits a later essay.

Science, too, has its commonalities and differences. The "hands on" philosophy runs through each level, although in some classes more espoused than in use. The "50-50" program in the elementary school leads many teachers into broader "unit teaching" which frequently will combine field trips, reading, projects, and both science and social studies. The flow of concepts across levels seems a major kind of problem. Hierarchical or spiraling relationships are not clear. As teachers in elementary, junior, or senior high school "do their own thing" and have access to a wide range of film strips, films, "packaged experiments," and their own accumulating files of materials and ideas, then one can find electricity in the primary grades, the junior and senior high schools, or find atomic stories, concepts, and measuring devices discussed at multiple levels.

Social studies shifts from more generalized problem solving and accumulation of knowledge exemplified in the Data Bank program at the elementary level to a broad-based history, i.e., American studies at the junior high level. The senior high program is mostly history with some anthropology and contemporary social problems. The historical approach gives a strongly integrated perspective to the senior high program. In the eyes of the faculty, the youngsters "really know some history." The articulation from junior to senior high and the interrelatedness of the high school program around the historical perspective has major advantages. The loss in sophistication of other modes of analysis--contemporary experimental and quantitative social science--poses difficult value, theoretical and evidential problems. For example, is the well-trained-in-history student now ready for a similarly "serious" program in contemporary social science and able to profit from it? Or has he learned a style of thought, more akin to the humanities, and is "forever lost"? Bringing to bear empirical evidence, if that's the kind called for, on such a problem in curriculum, teaching, learning and development seems very difficult.[20]

The interrelation among disciplines is intriguing in its complications. At the elementary level, the project and unit activities seem to be toward the high end of this dimension. In the junior high, the teams (science, math, social studies, and English) are relatively recent in origins and so far seem more organizationally and administratively convenient for pupils, teachers, and administrators. The evolution into curricular and instructional integration seems on the agenda of many of the staff. At the high school, the science department builds heavily on the developing mathematical concepts and computational skills of the youngsters. From the initial quantitative science in the ninth grade on through the Q biology and Q chemistry into physics (which require advanced algebra and trigonometry), the programs are integrated. The math program builds less this way on science. Although in the math classroom observations, several references were made to "how we do it in science." History runs pretty much independently, although we had conversations in which occasional attempts of "history of science" lectures and teaming were carried out.[21]

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[20] One is reminded of C.P. Snow's Two Cultures (1960) and Liam Hudson's studies of clever boys (1966, 1968).

Running through all of the areas (e.g., the IPI controversy) is minimal teacher first-hand, direct observational/personal knowledge of the program at levels other than one's own. This is true of math, science, and social studies as well. By the simple fact that each level is in a separate building--and some levels have multiple buildings--a profound change occurs. In part it is proximity--simple distance from each other which minimizes contact and interaction. In part, each building has its own environment, its own patrons, its own traditions, its own administrators. To a degree it evolves its own system, as we have argued at several points in the report.

Pupil Movement Through the Curriculum

One of the aspects of formal curriculum, which seems to vary across school districts, is the manner in which the youngsters move through the curriculum. Against a backdrop of state and district minimal requirements, and counsel and advice from the staff, the students in the Alte Schools elect particular courses. As has been indicated, the first options occur in the junior high school in math.[22] In the seventh grade, children (and their parents) are counseled into regular math or pre algebra. In the eighth grade the options are regular math and algebra. The decisions are made by the parents and children; but the major sources of influence are teacher judgments of the child's ability, interest, and probable performance, as well as standardized achievement test scores indicating levels of attainment against both national and local norms. Again it should be emphasized that the final decisions are made by the parents and children. If a parent wants his child in the pre algebra or the regular math, the placement is so made.

This is the first step in what will be an increasingly broadened process of choice and differentiation in what is studied and learned. Increasingly, youngsters move in terms of interest and experience (prerequisites). Geometry isn't taken unless one has had algebra; biology is after one has had Science I or quantitative science (Q Science). The latter presupposes credit (or concurrent enrollment in) algebra. This procedure obtains throughout the math and science program, less so in social studies. In a fundamental sense there is homogeneous grouping by choice--based on motivation, interest, and competence. Competence is defined as experience--satisfactory attainment in a prerequisite course. The motivation criterion was commented upon by several teachers as, "There are several youngsters in this class who could be in a more advanced class but they didn't want to work that hard." The interest criterion appears in a number of students who opt for advanced work in other departments, e.g., English or foreign language rather than math or science. Even this has its complications, as one girl commented--"I'm really not interested in science [she was in a senior physics course], but this will be the last science I'll probably take. I'm hoping to major in foreign language in college." She indicated she had already been accepted in an Eastern school.

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[21] The intent of these comments is to be neither critical nor laudatory, mostly to reflect curiosity. Perhaps there is an empirical literature on these aspects of curriculum integration--both antecedents and consequences. This observer is not aware of it, however.

[22] Also in other domains, e.g., foreign language, but these are beyond the scope of this analysis.

In Alte these choices are not complicated by race or socioeconomic factors. The community is homogeneous in these regards. Sexism, if present, is institutionalized. The choices are possible; however, fewer girls than boys take advanced science and math. A number of teachers take strong value positions here. One teacher commented about self images of female students.

> The girls say "I'm not good at math" and find excuses not to continue studying it. But the boys say "I think I could get it--I just don't study hard enough." I have been working with the girls, and I might have gotten a few back on the right road this year.

If these comments are veridical, if one subscribes to the value position that equal numbers of girls should be moving toward professions involving science and math and if the youngster's parents agree, then the attitudinal roots lie, in part, well before the curricular choices in the high school.

Summary

Over the years, educational psychologists of a measurement persuasion have had an ambivalent relationship, with disdain perhaps the modal sentiment, to accrediting agencies such as North Central and instruments such as the Evaluative Criteria (NSSEE, 1969). Rating scales have their own intrinsic problems with interobserver reliabilities, definitions of end points, and equality of internals in between. Further, ratings of schools, classroom events, and teaching do not correlate well with results of achievement tests. In the present discussion of formal curriculum and the attempt to highlight dimensions, the skeptic might see nothing more than the rediscovery of the Evaluative Criteria.[23] Perhaps that is so. And maybe it's a good thing as well. As we have looked at the Alte Schools, from the perspective of a hundred years, they have changed in some remarkable ways. This has been an attempt to talk more precisely about those similarities and differences. Precision in theory and language may even be a precursor to precision in measurement and lead to a renewed, but altered, attack on significant educational problems.

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[23] Our intentions had been to take seriously this doubt, which we share, and our belief that a major underanalyzed issue lurks within. That essay must await another occasion.

Informal Curriculum: Degree of Enrichment

The teachers and the administrators in the Alte District do a number of "extra," "additional," "enrichment" activities with the children. Essentially they are components of the curriculum which occur outside of the regular course content. It's difficult to find an appropriate label but "informal curriculum" or "enrichment curriculum" might qualify. Similarly, it is difficult to imagine how one might measure this attribute of a district's curriculum effort. Perhaps by presenting two illustrations we can capture some of the flavor of the phenomenon. The first is the community history carried out by the junior high pupils and their social studies teacher. This resulted in the formal publication, Images of Our Community--Alte. In some ways it paralleled a 1931 document, The Story of Alte, which was also published. While we do not have base rate data, two published social studies documents by junior high pupils seems rare and unusual. The second project is much larger, more complex, less unified and spreads all through the district. Roughly, it might be entitled outdoor education. It includes such varied activities as sixth-grade camp, junior high school all-day canoe float trip on a nearby river, several different summer programs in ecology, and environmental studies with kindergarteners, elementary, and junior and senior high school pupils.

Outdoor Education

From the initial interviews with the principals early in the semester we began to hear about Alte's Outdoor Education Program. The program is diverse and extensive in time--fall, winter, spring, and summer. Rough categories of activities are listed in Figure 14.

Insert Figure 14 about here

Instead of a detailed account of the total program, brief experiences in which the observer participated will be described.

The Alte School District has had "sixth grade camps" for several decades. In recent years it has evolved into a quite complex undertaking.[24] It is planned and run by two district administrators. It is staffed by all the sixth grade teachers and by other staff interested in outdoor education who come part time to the camp from all levels (elementary, junior, and senior high) and

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[24] The story of this evolution, as we came to hear it, suggests the generality of most of the theoretical ideas developed out of the IPI illustration earlier in the report.

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	Arboretum Activities	Arboretum Activities
	Mini Courses: Counseling	Counselors in Training
Arboretum Activities		Alternative School Program 1. Ornithology trips 2. Cabin rebuilding 3. Local town history
One Day Overnight	Overnight	
Sixth Grade Camp		
Summer Program (Kgn. & 1st Grade)	Four Week Summer Program	Summer Camping Climbing, Exploring
Elementary Level	Junior High School	Senior High School

Figure 14. Outdoor Education - Alte 1977

all areas (industrial arts, mathematics, foreign language, etc.). In addition, high school youngsters are counselor aides. The program is structured around four major "days" of activity.

1. Potpourri Journey
    1) Orienteering
    2) Outdoor Project
2. Nature Journey
    1) Pond
    2) Forest
3. Cave and Lake Journey
4. Bluff and Creek Journey

An illustrative anecdote or two brings to life a bit of the quality of the experience as the observer participated in a morning's canoeing and an afternoon's nature journey.[25] From the summary observation notes an incident or two are excerpted.

> There's another long episode that I don't think I got into these notes yet. As I glanced over some of the field notes from yesterday there was a reference to the turtles. It's part of the collecting enterprise. As we were roaring off in the van, going to the canoeing area, we went by a big turtle on the road. The driver stopped and one of the teachers got out and brought it into the van. It was going to be added to the collection. Later we found another. All on the way to canoeing. The kids were interested and played with the animal, watching it as it moved...
>
> While we were on the lake in the canoes, we spotted a number of water turtles with a much flatter back and body, sunning themselves on logs and stumps. In one spot there must have been a half dozen. The kids all paddled over to have a look. I was surprised that the turtles were not skittish. The kids got up quite close before they took off.
>
> We also discovered another box turtle about fifteen or twenty feet or more out in the lake, swimming in the "wrong" direction, as it were, toward the other side. We circled around as the girls in another canoe made one pass at it and missed it, then we picked it up on a paddle. It was a small one, and we gave it to one of the girls. The important point I want to make about this story is the tremendous involvement and interest that the kids displayed in the animal when they got to the beach where

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[25] When he arrived early in the AM, the observer was greeted by the Camp Director with, "How about helping out with the canoeing and caving trip?" A month earlier we had been involved together in a day-long canoe float mini course.

> we were to await the others and have lunch. Anywhere from two to six or seven of the kids literally played for half an hour with the turtle. They built a sand castle and would suspend the turtle on it and then while the water washed the sand away they would watch him move to and fro and about. Similarly they built runways for him and engaged him in turtle swimming, turtle climbing, turtle walking, turtle falling, etc. Again, a full half hour. He was brought over to join us for picnic lunch. All in all, he became one of the major foci of activity...There was a bit of that kind of spontaneous activity that seemed to be going on everywhere.... It got integrated with other activities.... The turtle eventually ended up in the Nature Lodge with the frogs and toads and tadpoles and all kinds of water beetles and diving bugs.

The story is a small one, and just one of dozens,if not hundreds, that the sixth grade youngsters experienced during the week.

The Nature Lodge was developed primarily by staff and students from the Alternative High School. The notes try to describe it.

> The nature study center was probably one of the most creative and biggest hits of the whole week. The teacher and a half dozen of his kids brought out a whole set of equipment and materials and set up shop in one of the out buildings...empty acquariums, work tools, a library. It was an incredible picture.... And everyone seemed to be working in, working on, and working about with the materials....
>
> Briefly, they had a microscope that gave two to twenty magnifications. They had that down at the pond where they were collecting specimens. The good microscope, three hundred power (?), was at the Nature Lodge. The inside room was set up with a row of cages for animals they had collected--at least three kinds of snakes (black, garter, etc.), a spider with a big cocoon of eggs, a big black spider, and all kinds of beetles and bugs. Apparently, last night they set up some kind of night light that had an eerie sort of glow about it, and attracted all kinds of insects which they caught, and put in test tubes, and are currently looking at, examining and identifying, etc.... They had set up a table with a library of books on trees, birds, flowers, shrubs, insects and you name it. One of the high school girls was doing what she called a "transect," a kind of census on a strip of land running through the park. She is trying to identify every living thing within one square foot and then another, etc. I don't know all the details, but the census seems based on a reasonably common set of procedures and seems to have no big difficulties inherent in it. The image she

> conveyed was that of a busy working scientist. The job was a real one, the task was difficult in that the array of insects, wild life, flowers, etc. is very great....
>
> Outside, in a kind of breezeway, also was a kids' wading pool, into which they had put a lot of rocks, water, and their specimens. They had toads, frogs, newts, some kind of diving beetles, turtles, and everything that moves that they could get their hands on....
>
> Inside, a teacher and some of the high school students with some occasional help from some sixth graders were building a cage for a new snake they had caught when they were down at the pond. They had some heavy wire mesh and a pair of wire cutters. They clipped and bent and shaped the wire mesh as a lid for one of the aquariums. They put leaves, logs, and other stuff into it for a habitat.

The story goes on and on. Tentative generalizations arose and moved in a myriad of directions as the observer tried to come to grips with the experience as an aspect of science education. For instance, (and, once again, from the summary notes):

> The contrast of this kind of experience and the ESS experience and a more textbook experience is one that needs to be looked at and brought out with intensity and beauty. . . Two or three dimensions . . .play back and forth here: the realism of the problems, the hands on aspects, the total living experience, the kids' contributions....

And at another point:

> One of the bigger generalizations I guess I've made about outdoor education as it's practiced in Alte is that it's really the Boy Scouts come to the public schools.[26] I can't get over how many experiences I had in scouting--both in the sense of taking it seriously as a youngster and doing a lot of things on our own in conjunction with the program--which are occurring or happening with the kids here.
>
> There's a very interesting complex of experience that really needs to be checked out in some ways more fully and carefully. It blends into the kind of quality of

---

[26] Several staff members took strong exception to this kind of crass reduction.

> life that people might live, it ties in with rounding out the more general development of the kids beyond the sort of things they get in the high pressure, academic excellence type of program.[27]

The final notes of the day stated and understated. "It's been a profitable day. And a bit of fun, too."

Community History Project

Serendipity is both a process within, and a joy of participant observational research. Early on, the observer was hunting for documents on the history of the Alte Schools. A librarian put him on to Images of Our Community - Alte, a publication "By Members of the Alte Junior High School," an intriguing document in its own right. In turn, it became the basis of a number of conversations and interviews which revealed additional aspects of social science education in the Alte Schools.

The booklet itself is a sophisticated piece of work--historically and pedagogically. The initial paragraph of the Introduction is a first instance.

> We have entitled our booklet "Images of Our Community - Alte." Perhaps we can never discover the "complete" history of Alte. Perhaps history is only a collection of images. We do know that communities have "images," but we are more interested in the people behind the community images. We have studied the images of our community here in Alte and have spoken with many people who gave our community its life and meaning.

The introduction was written by two of the students. Each section of one to several pages carries the name of its student author.

The problems faced in getting themselves organized to do this were ubiquitous. "What to do? and How to accomplish it?" were the broad categories of issues. Should it be an in-class or out-of-class project? How to foster and handle the emerging leadership of the youngsters? Relationship with a similar project in the community--and the not so latent competition for data, for pictures, for getting finished on schedule were also problems. These issues merged with problems "in the field." Who to interview? What to ask about? How to get permission? How to handle the "emperor's new clothes" phenomenon: the youngsters' unawareness of some of their elders' sensitivities and prejudices, growing awareness of the implications of some of the direct and frank questions, the issues, the problems.

---

[27] Later comments were made on the difficulties in measuring, assessing, and testing some of the implications of such hypotheses.

The methods were a blend of oral history and primary and secondary sources. The faculty sponsor, a junior high social studies teacher, taught the children how to do oral history--techniques from his own graduate school background. He dittoed a set of "tips," do's and don't's from Baum's pamphlet on oral history and the interview process. They worked out lists of people to see and eventually taped over two dozen interviews of present and former citizens. Several major primary documents, local newspapers, were available only from the State Historical Society. Microfilm copies were secured and scanned by pupils who were "microfilm readers."

The content carries the stamp of the youngsters' knowledge--a dedication to their teacher, a listing of staff, and acknowledgements. The content breaks out into "The early years," "Alte and its people," "Alte's curiosities," "Alte's future," and a "Conclusion." It's full of pictures, anecdotes, stories, and descriptions. The oral histories produced page after page of delightful quotes:

> I don't think the roaring twenties changed Alte too much. I think that everybody that had any "roaring" to do went out of Alte to do it.

And, it also produced delightful stories of pioneer ancestors, e.g., the lady who fell into a cistern with her child and stood neck high in water, holding her four year old on her shoulders until her husband came home for lunch five hours later. Nor did the youngsters shy away from more controversial issues of race, religion, and commercial development encroaching on residential neighborhoods.

The origins and consequences of the project are multiple. Without elaboration these have been sketched in Figure 15.

Insert Figure 15 about here

The story is both richer and more dramatic than our account. The complications within the school, the larger district, and the historical context are part of that story. Suffice it to say, it was a major educational effort.

Curricular Competition for Time, Energy, and Enthusiasm

In the course of the semester a number of comments were made by teachers about the Community Science Fair, a metropolitan exhibition of projects, awarding of ribbons and prizes, and local hoopla. The teachers in Alte have participated minimally in recent years. Their feelings were expressed in such comments: "It's a parent thing," "It's a mess," "Some kids didn't do anything else all year," "I'm glad we're out of it," "Don't get us back in that."

While our data aren't extensive, a variety of factors seem to be at work. The major one seems to be a waning of interest and

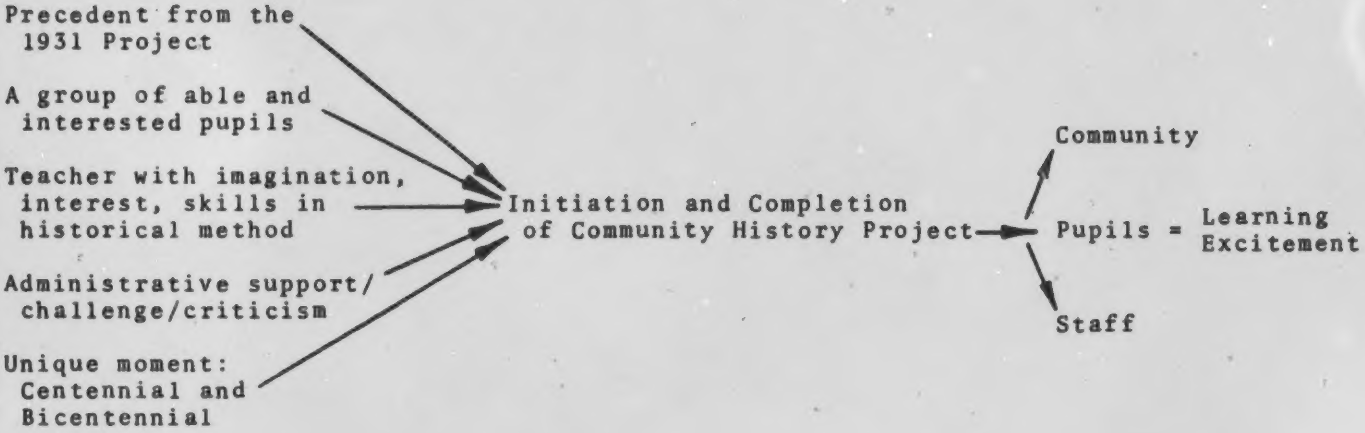

Precedent from the 1931 Project
A group of able and interested pupils
Teacher with imagination, interest, skills in historical method
Administrative support/ challenge/criticism
Unique moment: Centennial and Bicentennial
Initiation and Completion of Community History Project
Community
Pupils = Learning Excitement
Staff

Figure 15. Antecedents and Consequences of the Community History Project

enthusiasm over the years. Novelty is obviously a major motivator of teachers and children. Having done it before--a dozen or more times for an experienced teacher or several times as a pupil--becomes a powerful determinant on the "next time around." It has little to do with the intrinsic merit of the activity itself. In addition, other activities, with equally good intrinsic merit--"outdoor education," a day long bus trip to Chicago's Museum of Science and Industry for the junior high school pupil, or a special program such as "Truman Day" or an "Individual Choice--Mini Courses" set of experiences--arrive on the scene. These capture the attention and imagination of staff, students, and parents and bring their own benefits, problems, and costs. In Figure 16, a partial listing occurs of some of those we participated in, ran into, or heard about in conversations.

Insert Figure 16 about here

It's difficult to resist talking about our entering into a debate with some very talented youngsters on whether President Truman should have dropped atomic bombs on Hiroshima and Nagasaki and the attempt to sort out issues of fact from issues of value and the weighting of each into a coherent argument. Similarly, a day float on a lovely Ozark river, the excitement and anxiety in an overturned canoe under a windfall in the main channel, the lazy picnic lunch, the cave exploration, and the long paddle to the take-out point. And the parental comments of the kids' pleasure in the activities and in getting to know further dimensions of their teachers. Or finally, an evening at a metric fair where we found out how far--in kilometers--it is from Alte to New Zealand and London, how much we weigh in kilograms, and how complicated the translation from English to metric units is when the translations are built into puzzles.

Conclusion

Conceptually, several critical conclusions seem embedded in the description and analysis. First, the category of events seems half way between the formal curriculum and what is generally called extra curricular activities. The community history project is more of a long episodic/one shot phenomenon. The outdoor education program is more entangled with the regular program--especially in science. It is evolving, changing, shifting about. At this point it's not clear whether it will eventually be institutionalized as part of the formal curriculum or separated out as an extra-curricular activity. As such, its importance conceptually may lie in its quality as a case study of curriculum change.

1. Outdoor education
2. Community history project
3. Metric fair
4. Mini course day
5. Metropolitan math competition
6. Science fair
7. All day trip to the Chicago Museum
8. Truman Day

Figure 16. Enrichment Activities in Science Education

The illustrations and analyses have been too brief.[28] These instances of informal curriculum play back through the earlier dimensions of curriculum, e.g., interrelatedness between elementary and junior high and between junior and senior high schools and breadth of curriculum. They also suggest other dimensions--involvement with community, parents, applications outside the school, and more general personal development.

Curriculum as What is Taught: Vignettes of Teachers and Teaching

Very early in a conversation with one of the teachers the concept of formal curriculum came under attack. In his view, going through course labels missed the point of the quality of what is taught at Alte High and its superiority to what is taught under the same course label at other high schools in the community. Whether Alte is that much better than other places requires data beyond what has been gathered in this case study. The point, though, is an important one; it seems to have several aspects. First, what is taught might be presented best by a careful analysis of (1) textual and other instructional materials--readings, films, laboratory exercises; (2) in-class reporting of pupil teacher interaction (monologues, dialogues, questions, etc.); and (3) student thinking, writing, and examination responses. For purposes of brevity, a half dozen vignettes--across grade levels, disciplines, and schools--will be presented.

Beside capturing pieces of the realities of what is taught beyond the course labels, the vignettes raise directly an aspect of latent curriculum, the idiosyncratic styles of teaching. The Alte Schools have some "living legends" whose classroom personalities and styles are important variables. In the research literature these seldom are described carefully and are nearly impossible to measure adequately with currently available techniques. Our hypothesis is that they contribute significantly to pupil personality development--aspects of learning and achievement including and beyond what is usually measured in standardized tests.

Quality of Mind: Teacher A

One of the science teachers, a former student and old friend from years ago, enjoyed seeing the observer about the building. We had coffee and conversation on a number of occasions. In the course of the semester and over the half dozen visits he brought reprints of things he ran into in science education which might be pertinent to the investigation and which the observer, as a non science educator, might not run into. Typically, they would be accompanied by a note or comment.

---

[28] Once again a major essay lurks within these programs, their antecedents and consequences. In part, we need more data; mostly, however, more time for analysis and write up.

> "For your NSF program--I don't recommend these articles--Please eventually return the magazine. No hurry."

And so it went all semester. A sampling of titles appears in Figure 17. Most were from *Science*, the journal of AAAS, from *Science and Children*, and from *The Science Teacher*. A few were local items.

Insert Figure 17 about here

The point, though, is not one of methodological help, as important as that was; the point is the evidence of the quality of mind possessed by one teacher, idiosyncratic but not atypical of the staff. Which teachers read? How much? What kinds of things? How important is it? For what kinds of consequences? How easy is it to change? By what procedures? All these become relevant questions regarding the broader issues of science education and the quality of teaching and learning in the schools. They seem implicit in this simple set of events, a science teacher passing along relevant items to an old friend.

The Other Half of Math: Mrs. B[29]

Not all math in the elementary schools is IPI nor is it text book bound. By chance, and unannounced, one morning in the course of trying to sample broadly, the observer viewed a "math lesson." Actually, the morning was supposed to be language arts, spelling, and art. But the teacher commented, "As long as you're here we can do some math. I was planning it for after lunch but we can try it now." The observer settled in, out of the way, and made a few preliminary notes.

> She has about 25 kids in what is a 2 1/2-3 classroom space.

Actually the room was constructed from two classrooms. When the walls had been taken out the extra part came from a large cloak room which was now part of the classroom. In addition, since the area was at the end of one of the legs of a "u"-shaped building, the original hallway became an "anteroom" with overstuffed chairs, tables, storage, and spillover for pupil activities. The notes continued:

---

[29] Until this project the observer had never met Mrs. B.

1. "Activity Oriented Science, Is It Really That Good?"
2. "National Academy of Sciences: How the Elite Choose Their Peers"
3. "Aftermath of the New Math: Its Originators Defend It"
4. "The Emergence of Ecology as a New Integrative Discipline"
5. "Social Anthropologists Learn to be Scientific"
6. "Farming Communities and the Demands of Archeology"
7. "Science: Too Much Accountability"
8. "Atkinson to Head NSF?"
9. "TOTSI Matches Teacher to Curriculum"
10. "Teachers Who Care"

Figure 17. References thought to be "of interest" to an NSF investigator of science education

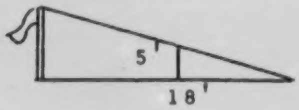
> Room looks like something out of Elwyn Richardson or Ellsworth Collings: (1) variety of mobiles hanging from ceiling, (2) plants on south window sills, (3) pictures, photos, maps of science everywhere, (4) at least six expensive microscopes on side tables.

The references to Richardson (1972) and Collings (1926) are to two of the clearest and most vivid statements of "activity" or "project" curricula. Richardson writes of his experience in combining art and science in the education of Maori children in rural New Zealand. The point of view is part of the elementary curriculum in teachers colleges there.[30] The Collings book was an early progressive education experiment in rural Missouri carried out some sixty years ago under the direction of W. H. Kilpatrick. Seeing those ideas come alive in a sophisticated, well-to-do upper middle class suburban community raises a series of provocative questions.

After taking care of attendance and lunch count, the teacher began. The notes continued with a mix of quotes and summary description:

> "We'll do a little more on measurement. Need paper, pencils, and protractors."
>
> Kids make mad rush for box in the back of the room. Several protractors short. Partners.
>
> "Name in upper right hand corner. Title for this paper 'Indirect Measurement.'"

This was demonstrated using an overhead projector and a method of printing with a ruler as base for level printing. Concomitantly a discussion was underway on the meaning of "indirect measurement." After a comment or two, one of the pupils suggested, "Can't do it directly, next to it." She talked as she drew on the overhead projector. The observer caught a series of phrases in a discussion which moved too fast:



> "Review ...lying down flat a five foot pole seems as high as flag pole top...one or two eyes...[one] ...What called? ...[Parallax] ...someone generate some numbers...bottom line of small triangle 18 feet... What is unknown? ...[Height of flag pole] ... Instead

---

[30] The observer spent a year at Massey University in New Zealand on a Fulbright-Hayes research fellowship. While there, he visited a number of teachers' colleges, secondary schools, and elementary schools, some of which were mostly Maori.

of question mark we call it X... Between you and me it's like algebra... Need one more piece of information...[31 ft] all right length 31 feet... Can I convince you to make it a little bigger. If this is 18 then, how about 46... What do I do now...Bunch of show offs, you can't do it."

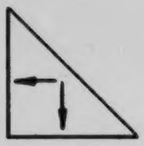
Kids volunteer 5/18
Talks about the "little triangle."
Kids pop it right out "5/18 is like X/46"
"18 X = 5 X 46"
"18 X = 230"
"Here's a tricky one..."
"Can't throw anything away X = $18\overline{)230}$"
Kids do it
"What if there's a remainder?"
She divides with their help
X = ~~12~~ 13'
"Since it's so close and since 'guesstimates,' make it 13'."
She then integrates back to earlier lessons with a
"Who thinks they have it down for last two problems?"
Most say "yes." "Save for your folder."

At this point it was 9:02, and the rapidly moving lesson moved on. A couple of comments and everyone was in motion again. "Need scrap paper for new problem," sent most back to the shelf where the one side of used ditto paper is kept. "Where's my gizmo?" had a pupil off to her desk for what she calls her "gravity protractor": that is, a large wooden protractor (normally for drawing angles on the chalk board) with a hollow tube (from a role of foil) taped to the base and with a piece of coat hanger swiveling loosely in a hold at the origin. In the next thirty minutes, the pupils drew several horizontal lines on their scrap paper, did perpendiculars, had a side lesson on the problems of using ink and smearing, talked about right angle and 90°, and angles that were half that--45°. She raised the label "hypotenuse," they got its spelling from the dictionary; she helped kids who got angles wrong, challenged "check angle there; bet you dollars to donuts it's not 45°," and encouraged "Fantastic, you guys aren't supposed to know so much." The observer's interpretive aside.

> (Obs - She's a real pro at this informal activity-oriented style. Kids busy, interested, full of relevant info re geometry, math--degrees, angles, hypotenuse, 90° = rt angle, etc.)

She continued checking around the room, commenting, helping, and having individuals redo if the triangles were too small or if the angles were not 45°.

She brought the class' attention together with a comment, "Look...this is important...measure the sides opposite the hypotenuse." As she drew helpful arrows on one of her triangles, one of the pupils piped up with "What system?" and she replied, "Let's do it in centimeters." Shortly she asked and commented, "Think there's a relationship?" and "All right Mr. Pythagoras." Shortly, "these two are the same," popped up in several places. Amongst the questions and comments of "rounding," "sloppiness some where." She again drew the group's attention:



> "Ok, drop everything.... Let's write us a law... Thursday morning law...other sides, not hypotenuse, are the same.... How many got the same or nearly?... Everybody happy?... (yes).... If that is true is there any way to use it to measure?"

Then she drew a picture on the overhead projector of a flag pole, with flag flying in the breeze. "Call it X." A discussion ensues, a pupil has a difficult time expressing the 45° angle. "You're all right, it's hard to put in words." The discussion continues about different distances and needing some way to measure angle, a giant protractor. With a flourish, the home-made instrument is introduced--"Level it's 90°. When I tilt what happens? The children respond, "The needle changes." The action continues:

> "Can this help me?"
> "Yeah."
> "Can you make one of these?"
> "Poke a little hole in the protractor."
> "String and weight."

The discussion continued to move too swiftly for the observer's pencil and pad. In the next few minutes questions were raised regarding the adequacy of the law, "eye level at five feet," and the need to lie on the ground, more pictures on the overhead identifying the two 45° angles, a hypothetical ground measure of thirty feet, and an immediate pupil response that the flag pole must be thirty feet high.

At 9:38, almost an hour into the lesson, another major shift occurs. One pupil is sent to the LRC with the message that they will be down later. As she gets them ready for making their own gravity protractor, she sets the array of related and continuing tasks:

1. draw the 30' flag pole illustration in their notebooks;
2. finish their sun dials;[31]
3. make gravity protractors.

---

[31] Methodologically this seemed very critical. Earlier the observer had some concerns that he was being given a "special performance"; the sun dials were an even more elaborate project. In addition, parents reported on the excitement their children felt in being in her class. The activity was not atypical.

The next forty minutes were occupied with construction activities. An alcohol lamp was brought out to heat a needle for putting a hole in the plastic protractors. One pupil went for plastic soda straws for the tube. Multiple ways of attaching tubes to protractors were tried. Freezer tape was the most prevalent. Multiple devices for the gravity indicator were tried. Bent paper clips and thread with a metal washer as weight seemed to vie in popularity. The observer noted, "Everyone's moving. All busy." Along the way casual comments of the children were noted. They fit a number of categories:

> "Straws are here."
> "Bill, will you bend my paper clip?"
> "Are we going to get into X^2 and all that stuff?"
> "Let's go watch him pyro off!"

Through all this, the teacher moves about, helping, explaining, giving side lessons (e.g., how to use a pliers for wide or tight grip, the hottest part of flame, etc.), and raising related ideas (e.g., ping pong ball as possible weight, problems with wind, use angle to measure wind speed). The observer noted:

> (Obs - She's a provocative, thoughtful, creative gal. Seems to have an easy way with kids. Can build on their ideas. That's a most important skill, in ele, h.s., graduate school. Need to work that out conceptually).

> (Obs - The multiple activities keeps kids on all kinds of productive work.)

The lesson ends at 10:20, as materials are put away, as kids who have gone outside to try their gravity protractors are rounded up and as they get ready for language arts.[32]

Quantitative Biology: Miss C

The strength of a methodology which combines direct observation, informal teacher interviews, and a collection of documents seems well illustrated in Miss C's biology class. The field notes begin in the morning before class.

> Been in a few minutes in Miss C's class. Lab this AM, a two period module. She's busy with "popping beads"; as we joke, she attributes them to a geneticist working with BSCS, an NSF project: "Good enough for them; good enough for us."

---

[32] Almost as if to say, "You've hardly started," she commented about IPI as a teaching tool and liking to teach her own math, of integrating social studies with mythology, and of her conception, with diagram and all, of a theory of knowledge for organizing all of the elementary curricula. That has to await another day--and another essay.

As the kids straggle in, I look at Drosophila manuals:
Kaufman, R.P. Drosophila Guide (8th ed.) 1969;
Carolina Drosophila Manual, 1973.

Meanwhile, two other science teachers who share the lab and/or adjoining office facilities are in and out attending to chores.

When the students are in and attendance taken, the teacher begins a brief discussion of the experiment of the day. She relates it to earlier work on mitosis. She indicates the difficulties of "doing meiosis experimentally," therefore the popping beads. In short order, she has a diagram sketch on the board and has raised the concepts: chromosomes, gene, double chromatid, tetrad, chiasmata, spindle, and metaphase. Shortly, in small groups of four or five at the lab tables they begin "Investigation #11: Models to Illustrate meiosis and fertilization." Two brief quotes from the worksheet indicate the level of intellectual sophistication demanded:

> In the case of fertilization, what we need most to realize is how the random union of different kinds of male reproductive cells, or gametes, with different kinds of female reproductive cells will turn out.
>
> In the case of meiosis, we need to see how these different kinds of gametes are produced by a single diploid individual, through the synapsis and segregation of homologous chromosomes, with or without crossing over between them; and with independent behavior of different pairs of chromosomes.
>
> Because in the flowering plants and in animals, in general, meiosis leads directly to the production of the gametes (sperms and eggs), and fertilization results when sperm unites with egg, we shall take the model of meiosis first.

And later:

> Meiosis always requires two successive cell divisions, so that from each diploid cell that enters meiosis always a quartet of monoploid cells results. (It is not correct to talk about a reduction division--there are always two, one after the other, to complete the process.) In the first division of meiosis, while each chromosome replicates itself and consists of two twin strands (chromatids) held together at the contromere, the homologous chromosomes...

A brief interpretive aside captures a reaction relevant to this general point.

> (Obs - For me to follow the substance I would need to read a bit beforehand.)

The notes pick up the student activity:

> Kids keep lab books, work cooperatively by pairs of tables. Each of four tables has five or six kids. Miss C suggests one reader and several others doing. She floats around and helps. The group at my table seems to differentiate into those who have read and know what they are about [one boy and one girl]; others read, half follow, and occasionally question.

During the experiment the teacher stops to chat with the observer. "Miss C clues me in." Several points recorded in the notes represent a part of her outlook on Alte's science program.

1. Distinctive aspect is "hands on" approach.
2. In recent years, a shift in kids from quantitative biology to general biology--four sections vs. six sections. Used to be the reverse. She attributes to lower parent expectations and the fact that an able kid might get a three or four in general biology but only a two or three in quantitative biology. The kids want the higher grade average, regardless of learning, for the college admissions race. I asked re a possible 50% A's vs. 25% A's in different levels. This they do not do.[33] Spread in both. Seldom, however, is there an F in quantitative biology.
3. She shows me the lab books which she wants to be like a working scientist's lab book: notes and pre lab on the left and data, results and conclusions on the right, etc. (Obs - I'm reminded of a library exhibit of physicist Arthur Compton's lab books. I wonder re these as models: sources, generality, variety, etc.) The books are full of red ink. She spends a lot of time marking, grading, reacting. Last night she had to get some done for this a.m.
4. Talks of better facilities in other schools. Labs here are jammed with kids, apparatus, other experiments (planaria and fruit flies) from biology; also some from other courses.[34]

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[33] Some inconsistency exists regarding this and other courses in the program, according to other teachers' comments. No examination was made of actual grade distributions.

[34] A similar point was made by one of the site visiting teams who commented regarding lack of space for live materials--greenhouses and animal rooms. In terms of resources, some parts of the high school are less adequate than the elementary and junior high school facilities.

Toward the end of the period a final comment or two was made in the notes:

> One of five here seems out of it to me. Another asks, "What's wrong?" She replies, "I don't know what's going on." Miss C hasn't picked her up yet (time spent talking to me?). Leader of group activity is extremely able, according to Miss C.
>
> Kids gradually getting organized to leave, finish up, talk quietly. No bells, they gradually drift out. Tuesday is the period and a half.
>
> (Obs - The difference between here and in the Alternative School are immense.[35] The program here seems vigorous, intellectual, challenging. Can make of it whatever one wants.)

Almost as if to make that last interpretation with an exclamation point, an assignment sheet was given to the observer as he engaged in some brief chit chat with the teacher while closing out the observation. It appears as Figure 18.

Insert Figure 18 about here

A final entry in the notes reads:

> I go over to look at Planaria. Talk to Miss C and pick up assignment sheet, note text, quizzes, labs, supplementary reading, other materials.

A Traditional Textbook Lesson: Mr. D[36]

When one is away from classroom settings it is easy to be ideological about the intrinsic goodness of one mode of approach to teaching or the inherent evils in another. The observer saw several "classical" textbook lessons, one of these was in a slower algebra section. Mr. D was substituting for a fellow teacher who was out for the day and because "The subs won't come first hour." Before class, he was tutoring two youngsters, one on each side. The notes pick up the interaction:

---

[35] The week before the observer had been in the Alte Alternative School. More on that later.

[36] This and the remaining vignettes are shortened to just a glimpse for reasons of space and time. In the observer's eyes they were "stunning" performances and required more extended description and analyses.

Biology 6th week second semester Feb. 22 - Feb. 25, 1977
7th week second semester Feb. 28 - March 4, 1977

Text:

1st part Chapter # 13 - Reproduction--pages 299-311 Quiz on or after Feb. 28, 1977

2nd part Chapter # 13 - Reproduction--pages 311-321 Quiz on or after March 7, 1977

Supplementary reading:

Quiz on or after Feb. 28, 1977 -- Protopsychology, by Best, Sci. Amer., Feb., 1963

Memory transfer through cannabilism in planarians, by McConnell, Jour. of Neuropath. Aug., 62

Quiz on or after March 7, 1977 -- Moment of fertilization, by Allen, Sci. Amer. July, 1959

"Fertilization" by Metz, Frontiers of Modern Biology pp. 132-142

Laboratory:

Complete Lab S-18 Behavior of a Slime Mold -- Write-up due -- February 28, 1977

Continue Lab 14-16 Regeneration in Planarians -- note references above.
Each team will be responsible for a 1/5 page summary of their part of investigation

Mimoegraphed Lab -- Models to illustrate meiosis and fertilization
Popit bead Lab -- complete diagrams of each step of meiotic cell div.

Lab 13-6 Inv. reproduction in flowering plants -- Lab S-9 Growth of pollen goes with 13-6
Reference: Germination of lilly pollen respiration and tube growth, by Dickinson Science, Dec. 31, 1965

Lab 13-10 Inv. the life cycle of insects -- Observe development of this lab for two - three weeks. Note reference -- Drosophila guide

Other materials:

Mitosis and meiosis, programmed text

Structure and function of the cell, programmed text

Pollen, by Echlin, Sci. Amer., April, 1968

Germination, by Koller, Sci. Amer., April, 1959

The fertilization of flowers, by Grant, Sci. Amer., June, 1961

Lab report due -- Feb. 28, 1977
Lab S-18 Behavior of a Slime Mold

Figure 18. The Assignment Sheet From Quantitative Biology

They go back and forth re problems.
"Do you have the same thing I do?"
They do.
"Simplify both."

8:15 Most kids in and out. They ask about test papers and scores. Re one fellow who missed test and the teacher pins down carefully re his free period which is 7th hour. "Be sure and be there," he says.
(Obs - He has an easy but definite way.)

8:20 "OK, attention please. Try to do three things.

1. check paper
2. new material, division of binomials
3. do some problems in class; 15 at home."

They move quickly through the problems from the test. He stops and works those that are more complicated and have given a number of the students difficulty, for example:

#22 Pretty fancy
$4w(w-3)^2$
First, square the binomial, how many, $(w-3)(w-3)$?
$(w-3)(w-3)$
$4w(w^2-6w+9)$
$4w^3-24w^2+36w$.

As they work through the problem, he calls on different youngsters, seems to know about half of them, occasionally comments, "Don't have much time" and "Joe, if I have to stop and yell...," and continues the rapid pace.

The new materials begin about 8:35. A simple illustration of $16/2 = 8$, the check for it, $8 \times 2 = 16$, and the comment, "Think exactly like that." Together, with the teacher in the lead, they work a series of problems of increasing difficulty.

X^3/X^2, $6a^2/3a$, $-15c^5/-3c$, $18d^2/+6d^2$, $20ac^3/-5ac$

Throughout, running comments of the teacher appear:

"I'm getting tricky."
"Close, write it down."
"Ask someone for help."
"Lot like the other."
"Look at this part." (He boxes the element.)
"Come up with a rule."

As they come to problems with the denominator larger than the numerator, he comments, "a little different approach," demonstrates on the board, and remarks:

$3/12 = \frac{3\cdot 1}{3\cdot 4}$, pair this $\frac{(3)}{(3)}$, simplified version is 1/4

$\frac{X^3}{X^5} = \frac{X}{X^2}$, almost, $\frac{1\cdot X^3}{X^2\cdot X^3} = 1/X^2$

And later,

"Let's do a couple more before giving the rule."

After presenting the rule, he moves toward a total class exercise, in which he writes a dozen problems on the board, mixes up the kinds, and has the kids close their books and do them on scratch paper. He moves about the room checking individual papers. The observer reflected:

> (Obs - Teacher in motion. Responds to one kid's
> initiation--hand up. Personalized interaction!
> Extend analysis from Complexities.
> Different kind of thinking? Big issue.)

They begin on their homework in the remaining few minutes. As the bell rings he reminds them that their regular teacher will be back tomorrow.

Adversarial Teaching: Mr. E

Ostensibly it was a review lesson to help the students in a western civilization class write better essays on Magna Carta. The original assignment was:

> Utilizing the essay on Magna Carta by S. Painter,[37]
> show how the document brought forth:
> 1. the concept of limited sovereignty
> 2. the concept of "Right of Rebellion"
> 3. The concept of "consent of the governed"
> 4. the concept of "due Process of Law"
> In your essay cite specific examples taken from the
> readings to illustrate your points.

The class began at 10:04 with Mr. E passing out copies of the article, which the class had read previously, and asking, "Where in the article can we find questions?" and then the discussion moved too rapidly for complete note taking by the observer:

> Limited sovereignty - page and paragraph?
> Consent?
> Look at four questions?

---

[37] Originally published in The American Historical Review, 1947, 53, 42-49.

> (Obs - He pushes kids to look carefully. Kids seem with it.)
>
> Page 249, last paragraph...could never be an absolute ruler. . . . What is there about a contract? ...Definition of contract? Where are my Latin scholars?...

He illustrates with a brief comment about marriage contracts, eventually pulls "an agreement between two or more parties" from one of the pupils. He extends with, "Cannot be broken by one... neither party can violate it...limits...even a king can't violate it." Rapidly, aspects of "written vs oral...equally binding..., Henry 1st Charter of Liberties...Barons thought binding on Henry and all the succeeding kings" are raised. The observer commented:

> (Obs - He raises his voice, almost yells, then quiet again).
>
> What are Barons saying?...You have ignored your grandfather's contract. We'll write this one...let's look at King John's position...
>
> (Obs - In effect, he's telling a story, a narrative of west. civ. with some highlights. Story telling[38].)

The lecture/discussion continues, contrasts to American history are raised re constitution, Lincoln and the Civil War, and Nixon and Watergate. Then he's back to King John. At 10:35 he shifts to "right of rebellion." "Is it in the Constitution?" One of the youngsters vacillates. And he's back at Washington, Jefferson, Madison, and "Did you take American history? Did you study the Constitution?" The observer commented in the notes after these self evident rhetorical questions.

> (Obs - He crowds individuals and class intellectually, e.g., what happened to your rights of rebellion? Very different strategy in teaching here than with Mr. F.[39] He really probes hard.)
>
> (Obs - He offers kids a chance to fight him, to take him on. Discussion goes too fast. Need a tape recorder--a mix of Magna Carta, Declaration of Independence [not raised yet], constitution, Nixon, etc.)
>
> Why no longer have a right to rebel?

---

[38] A reference to an agenda of broader teaching skills on the observer's mind.

[39] Another social studies teacher who had been observed earlier.

> (Obs - One boy keeps pushing and teacher keeps fighting. The teacher's cantankerous approach is so much in his general personality; same thing he was doing to me, he does to kids. They aren't sophisticated enough to win.)

Later, as one of the students made a point about "limited orderly rebellion" and another, "might makes right," and the discussion on the point moves toward closure, the teacher comments, "Fascinating." The observer notes (Obs - He backs off). And one of the kids gets in a last lick, "Don't you ever answer your questions?"; and the teacher, not to be bested, comments, "No, they're too difficult."

So the hour went. It was exciting. It was stimulating. How other days go is not clear. The teacher commented that the kids bounce back and come at him again and again. He perceives them learning independent critical thought. Other teachers comment that they hear favorable things from the kids.[40] The major antecedent, as the teacher reports it, was an esteemed professor he worked with at the university.

Summary

These vignettes are but a few instances of interesting lessons, teaching, and teachers. The array of instances that might have been presented leaves the observer/analyst feeling he has slighted dozen of others. It even raised another alternative to the present report--a compendium of classroom protocols with minimal comment--more in the tradition of Terkel's Working, perhaps just called Teaching Science. The reader would be left to his own conceptualizations and interpretations, his own judgments and evaluations. In this way we could have captured a beautiful concept development lesson on force, mass, weight, and vectors. We could have seen the nuances of telling illustrations interwoven into dialogue and into clever questioning, of careful preparation over the years, which has tightened all the instrumentalities toward clear and specific goals. Or another teacher clarifying Mendelian genetics, phenotypes, genotypes, heterozygous, and homozygous to which the observer made an aside.

> (Obs - He has a soft gentle way with the kids, jokes a bit, e.g., "red-eyed males," keeps after the kids for answers, kids are attentive.)

---

[40] The kind of data needed to explore and tie down carefully the implicit propositions regarding antecedents and consequences of such a teaching style would be a project in itself.

And thirty minutes later in the same class:

> (Obs - I'm struck by the kids who are part of the silent majority, good kids, not especially academic, teacher helpful, easy going moves around the room, class is small enough that he can get around and attend to each youngster. He does.).

Then, there was a math teacher laden with an armful of papers and books (the math office is some distance away and inconveniently located) who was teaching advanced math to a group of seniors, many of whom were in a physics class the observer had visited a few weeks before. They were "feeling good" here, as they had been feeling also in science. The math teacher fed this feeling with a story of a teacher rigging participation with a class for the benefit of a supervisor. Everyone was to wave a hand at every question. Those who knew the answer were to raise their right hand, those who did not, their left hand. That way everyone was a winner. Then they started on math. "Any problems giving you difficulty?" The students would read a problem from their homework. The teacher would write on the board, pace about, engage them in math and byplay as he broke the problem apart and teased out the difficult component. To his "How come when I do them they come out?" he got a retort, "Why don't you take our tests?" As the give and take continued and as they worked their way through problem 11, in Dolciani's text Introductory Modern Analysis, the observer commented in the notes:

> (Obs - He kind of engages in a three-way jousting--him, them, and the problem. All good fun.[41] Kind of--why aren't you as good as me?).

Then they hit a problem involving graphs, rotated angles, slopes, tangents, sines and cosines. The teacher worked it out, commented "Hard to know what they mean?" checked out the answer key, found a different answer there, reworked the problem the other way, got the answer. The observer was dazzled and commented in the notes:

> (Obs - The jousting then becomes a four-way--me, you, the problem, and the text's author).

The teacher finished up with, "Enough of that. I won't ask you anything as hard as that," and moved on.

Then there were junior high social studies classes with simulation activities--a continent with countries resembling Europe pre World War I, and social studies with an impromptu elaboration of the concept of democracy to a youngster's confusion re "democratic" both as party and/or derivative of democracy. And an elementary science lesson using a kit from ESS; in a room with a sewing machine used for the geometry of patchwork quilts; and social studies, in part taught with a unit of free enterprise economics in which the kids built wooden flowerpot holders for profit; and some more of science taught out of doors in field trips. And then there was the conversation with an extremely able and creative sixth-grade pupil on a social studies field trip to the city hall where the youngster commented about liking a Rolls Royce we passed by.[42] The observer asked him if he'd ever heard of Thorstein Veblen. He said no. The observer teased him that he was a victim of "conspicuous consumption." He looked perplexed. His teacher joined in with a, "You can figure that one out." And he did. And we played Torrance vs. Getzels and Jackson for a while as we toured City Hall, with an unfortunately bland and uninformed tour guide.

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[41] Earlier (Smith and Geoffrey 1968) we called this banter. In Alte we found many sophisticated users of that mode of interaction.

This, then, is curriculum as what is taught: vignettes of science teaching in Alte.

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[42] Several weeks earlier, the observer had sat next to him in a Databank lesson and listened to and been impressed with his sotto voce monologue and also had been around as he pleasantly tried to "con" the IPI teacher aidein the LRC. The observer had visions of an off shoot case study of a highly creative youngster coping with mostly a highly convergent curriculum. Maybe next time?

Aspects of Curriculum-as-What-is-Taught: Latent Patterns

Each of the vignettes of teachers and teaching carries particular images. While the reader can make his own interpretations and judgment, the observer/analyst looked for patterns that would interrelate these discrete images with other particular images and other aspects of science education in the district. This involved us in a search for patterns and some provisional conceptual order in the wealth of diversity exemplified in the vignettes. The analysis highlights Alte's concept of the "strong teacher," the percentage of good/strong teachers, the centrality of the teacher in the classroom and "staleness" as another point on the continuum.

The "Strong" Teacher

Early on in the district we kept running into the expressions, "strong teachers" and "good teachers," occasionally appellations of prima donna. More rarely, "weak teachers" or "mediocre teachers" were mentioned. The conception seemed to be district-wide--teachers referring to their colleagues, administrators speaking of the staff within and across buildings, parents and school board members commenting on science education. Pupils used the simpler good-bad labels on occasion, or more colloquial, "she's great," "she's nice" references. Within the district there's more than a fair amount of agreement on what this means. Almost universally, the following are included:

1. a deep and abiding knowledge and interest in the subject matter (especially true for junior and senior high teachers);
2. knowing what they want to do with the subject matter with kids at the age/grade level they are teaching;
3. being "turned on," motivated, interested in their field;
4. conveying, stimulating, engaging the children in this set of learning, thinking, motivational processes; and
5. multi-dimensional aspects of personality and background--"second suits" of strength.

In brief, the norm seems to be, "What can you do educationally with kids." As one teacher expressed it about another teacher, "He's a hard act to follow."

Evidence for such a conception comes from a number of sources and observations. The system hires for this, supervises toward it, evaluates in terms of it, and ultimately relates to the citizenry in terms of it. Briefly, the hiring process involves an initial screening of applicants' paper credentials and a long series of interviews. The final applicants are then observed in their teaching if they are from a nearby district or teach a group of

Alte children if they are from out of town. The paper credentials give an immediate overview of the kind of institution, patterns of coursework, level of attainment (e.g., with honors).[43] The interviews permit an assessment of articulations in general and in terms of subject matter to be taught. They permit an assessment of the teacher's perspective, e.g., "What do you want/try to do with kids at this age level in this course, in this setting?" They permit a wider view of the personal and intellectual resources of the applicants, e.g., "What else do you enjoy doing with kids?" The observation of teaching, usually by two or three staff, permits an assessment of whether the teacher can put it all together with a group of youngsters. Here particularly, the search committee looks to the reactions and comments of the children in the class, the teacher's enthusiasm and his/her style.

A similar view can be seen regarding teacher evaluation in a document entitled Professional Evaluation, produced within the last year by a committee of teachers and administrators of the Alte School District. The document sketches out "expectancies" for "professional educators." Four models of assessment are included: supervisory, collegial, client, and a combination. Procedurally they are quite explicit. For instance, the supervisory model calls for a pre-evaluation conference, goal setting conference, classroom visitations (at least three), post classroom conference (after each visit) and a final evaluation conference and report. Items discussed in conference are grouped into goals, strengths, and weaknesses; items observed include broad categories of teacher as a professional, classroom atmosphere, and interacting with people. Each of these divides into a half dozen or more components. As staff talk of the system as it is beginning to be used, one gains the impression that there is both clarity and potency in the evaluation attempts. One of the most intriguing aspects is the implicit quality of "this is the kind of system we want, the kind of people who should staff it, the kind of teaching and learning that should be going on" and "these are the ways we are going to achieve it."

As the observer met the teachers--in groups and one by one--he was forming his own perceptions. These coalesced into two interrelated clusters which came to be called "three dimensional teachers" and "career professionals." The former refers to the simple observation/judgment that they were interesting people to be around and to talk to.[44] In the notes, the observer made comments of the order

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[43] Brief accounts of new teachers appear in the Alte News each year. Vita items such as these are part of the "description" of the newly hired teachers.

[44] Earlier, on another occasion, Professor Harry Broudy of the University of Illinois has talked with the observer of a similar idea which he called the aesthetic dimension of personality, the novel, the interesting, the dramatic aspects. Its potency, while unexplored in detail, has remained.

"Other extreme from most of the teachers described by McPherson in Small Town Teacher" and "Conversations sparkle with references to contemporary music, discussions of language and national character, relations of verb forms in Latin and early French, and such varied activities as gardening, weaving, scuba diving." Another example was the fact that people into outdoor education included administrators, shop teachers, language and math teachers, aides and secretaries. As indicated elsewhere, this brought striking resources into that part of the curricula. Overall the observer's reaction was that the staff was a distant cry from the stereotype of the dull, uninteresting image of "those who can't do, teach." Not only did most teach very well, but they also did a number of interesting things besides.

The "career/professional" category arose from a number of particulars. In one of the first interviews with a principal, a chance observation and an intentional comment were made by the observer about two books, Homans' Human Group and Webb, et al's Unobtrusive Measures. The principal replied that he had studied, worked, and published with several of the major figures in the "social science approach to administration" in other parts of the country. He was one of several perceptive theoretically sophisticated administrator practitioners the observer encountered. It seemed as though everyone the observer met had an M.A. (actually the figures are 75 to 80%) and that every other one either had a doctorate, had everything but the dissertation finished, or was in the throes of course work.[45] A number of the faculty teach part time in local colleges and universities. These assignments vary across methods courses and substantive courses in their disciplines. The sabbatical activities include research positions in industry and in university laboratories, different teaching assignments, and curriculum development work, as well as further professional training and advanced degrees. Scanning of the Alte School News indicates a number have won local and state awards as "Outstanding Science Teacher of the Year." Many have been involved over the years in national organizations, e.g., taking and/or teaching in NSF Institutes, and consulting on college board committees and examination writing and scoring. Finally, a number have developed their own course materials, outlines, laboratory experiences; a few of these to the point of commercial publication as textbooks, filmstrips, curriculum units. In short, as a group they are busy, active, career oriented professional teachers.

The twin phenomena of "three dimensional personalities" and "career professionalism" come together in what might be an "overlap of abiding life interests and teaching." Figure 19 indicates some of the elements in the conception and in antecedents and consequences.

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[45] The exact figures were not obtained. All the administrators (but one) do fit the category. Several of the "science educators" have completed their degrees and are addressed by pupils as "Dr. ____."

Insert Figure 19 about here

The conceptions are barely developed, quite hypothetical but consistent with the data and the overall impressions of science education in Alte. As social studies teachers do oral history inquiry, as science teachers work as park rangers and pursue avocations of bird watching, rock hounding, or photography, they bring interrelated activities to their teaching.

Some years ago, in synthesizing several studies toward a general point of view in teacher education, we sketched a several strand model of "phases and emphases" in the development of a professional teacher. That is reproduced here as Figure 20.

Insert Figure 20 about here

These comments were made about the strand on idiosyncratic styles of teaching.

> The idiosyncratic styles of teaching, which we have not emphasized explicitly but which we hope are implicit throughout this paper, would be in gradual development from the first experiences in teaching and should continue to blossom long into one's career as new emphases in curriculum, in instructional processes, and in the psychological and social foundations arise on the broader scene and as one builds them into or reformulates one's practices. In a fundamental sense the artistry of teaching should be a major focus and satisfaction in the profession of teaching. In our research we obviously do not have direct data on this from our dozen apprentices. More indirectly, the cooperating teachers seemed quite varied in this regard, although our data are not good in that we did not observe them teach to any great extent. Further examination of idiosyncracy as a means and as an objective in a psychology of teaching seems very important.
>
> (1972, p. 161)

In a sense, it seemed as though we were waiting for a setting such as the Alte Schools and its cadre of "strong teachers" and "living legends." Our vignettes have carried forward the descriptions. The analyses, while remaining mostly implicit, should suggest the exciting possibilities.

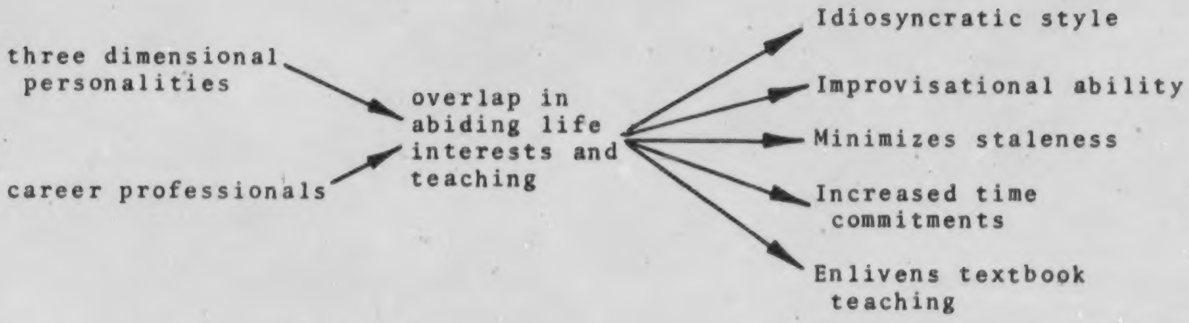
three dimensional personalities
career professionals
overlap in abiding life interests and teaching
Idiosyncratic style
Improvisational ability
Minimizes staleness
Increased time commitments
Enlivens textbook teaching

Figure 19. Implications of life interests and teaching

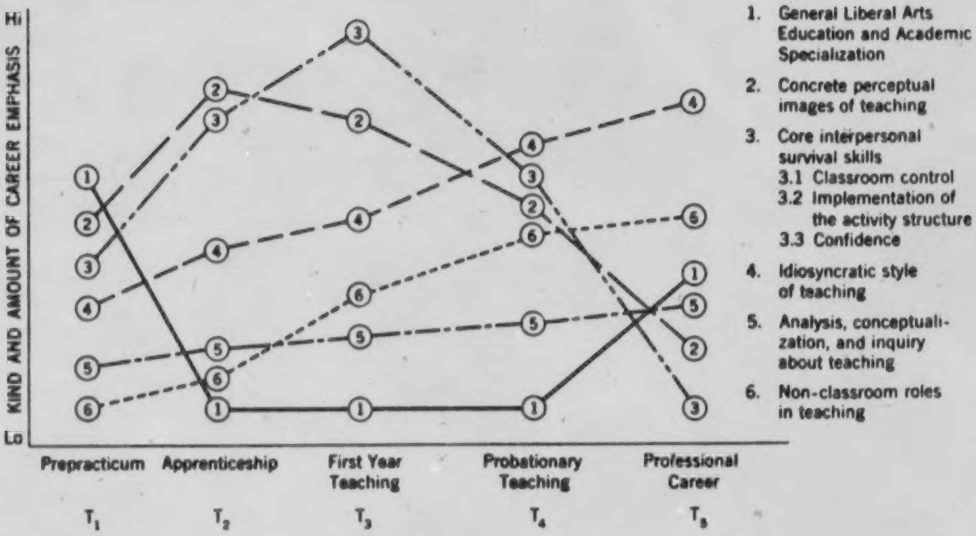

Figure 20. A Preliminary Model of Phases and Emphases in Developing a Professional Teacher (from Smith 1972, p. 160)

But, winds blow for both good and ill, if our data can be believed. One of the core elements of being a living legend is professional visibility. And with professional visibility comes a number of consequences: we have tried to capture those in Figure 21. The data come from conversations with teachers, administrators, and parents. The consequences include items such as esteem from students and parents, social rank in the faculty, and competitiveness in the faculty. These, in turn, engender power and influence which can be used for all kinds of purposes. All this may be good or bad, depending on who you are and where you stand as fellow teacher or administrator.

Insert Figure 21 about here

After a long interview with one of the teachers, who is commented upon by everyone as one of the best of the Alte staff, but who was recalling some of his class efforts, further insight into the negative aspects of the teaching situation arose. In the summary observations and interpretations, the observer caught it this way.

> In thinking about the situation stated by the teacher, it seems to me that one of the things that remains is the notion of the need to build in, both administratively and with one's peers, the kind of reward and reinforcement and acclaim that comes with doing a good job. Somehow that didn't seem to come for him from anyone. That left him with a very strong, unhappy, disappointed feeling. As he said, "I went into a depression for six months." Somehow, that seems to me to be a potent statement on the nature of things.
>
> One of the problems of systems that are composed of "stars," highly individualistic, competitive types of individuals, is that there isn't the sense of community that builds in the kinds of things that typically give those sorts of rewards and reinforcements. And that might well be a dysfunction of the type of system we've been talking about. It seems to me that that runs through some of the departments and between levels of schools in the district. It seems to me that there is enough of that kind of dissatisfaction that I've run into from several others to make it a reality.

The host of related issues that need to be synthesized here await another time, project, and data.

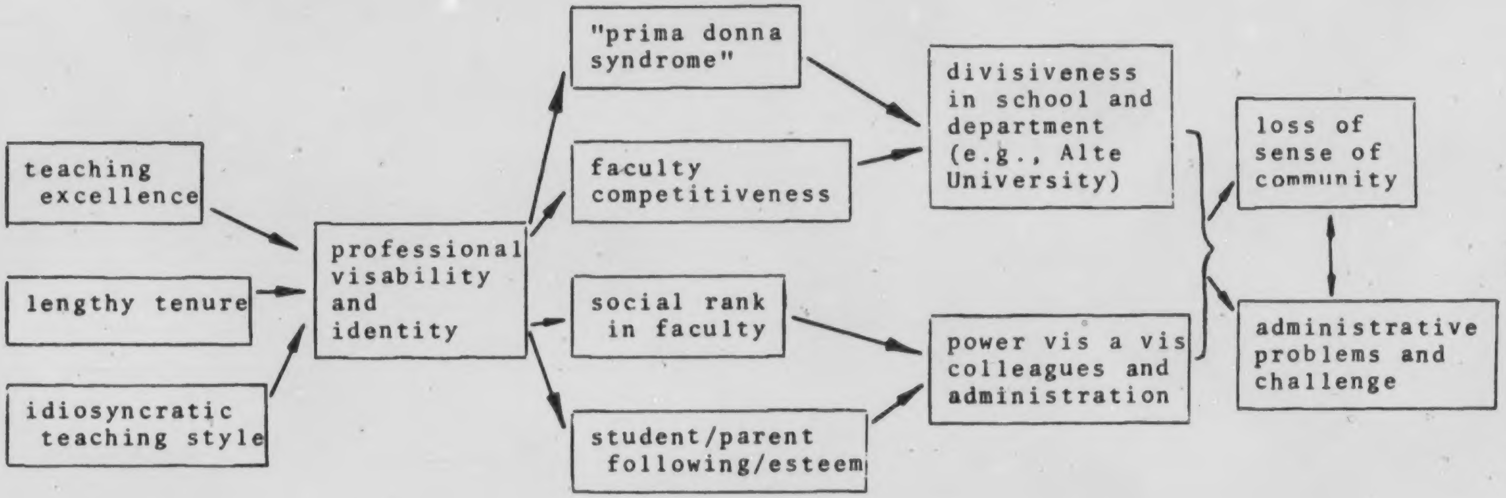
teaching excellence
lengthy tenure
idiosyncratic teaching style
professional visability and identity
"prima donna syndrome"
faculty competitiveness
social rank in faculty
student/parent following/esteem
divisiveness in school and department (e.g., Alte University)
power vis a vis colleagues and administration
loss of sense of community
administrative problems and challenge

Figure 21. Antecedents and Consequences of Professional Visibility and and Identity

Staleness: Another Point on the Teaching Continuum

Most of the excerpts of teaching that have been presented carry positive connotations--at least in the eyes and values of this observer. Not all the teaching was of this order. In some of the early observing, a sense of particulars coalesced into a pattern labeled--"teachers who have gone stale." The mix was a flatness, a lack of vitality (physically, personally, and interpersonally), a seeming lack of interest in the curriculum (science, math, or social studies) by both the teacher and the children, a lack of creativity and curricular risk taking, a negativism toward the children--they're spoiled, they don't care, they don't try--and sometimes a negativism toward colleagues, administrators, and college and university training programs (often decades ago). Age seemed a correlate; gender did not.

After this had been identified tentatively, it was explored in the latter part of a number of the exit interviews with teachers, administrators, board members, and citizens. Invariably, "it blew the interviews wide open"; that is, the interviewees agreed that the phenomenon (or their own conceptualization of it) existed, that it was the problem in the district generally. Some of the individuals went on to explore the issue for upwards of an hour. Some would have continued longer but for other appointments and classes and the amount of time we had already spent.

The major ideas that developed were these:

1. It was not just a problem in science education.
2. Some saw it as not a problem of "going stale," but a problem of some teachers who were "average/adequate" but not "good/excellent" from the start. Most interviewees eventually came down on the tenability of both hypotheses.
3. Most argued that Alte had many fewer teachers in in this category than other school districts, both absolutely and in terms of percentages.
4. Many talked in detail of Alte's complex approach as to resolving the problems at both the level of the individual schools and at the level of the district. These approaches were felt by them to be the most comprehensive and sophisticated in the metropolitan area.

As an issue, it led the observer/analyst into a wide range of additional phenomena, events, and interpretations. As with each of the other major sections of the project, it tended to tug at an observer's time and interest and threatened to become the thesis of a redefined project. Keeping it in the perspective of "Science Education in the Alte Schools" became difficult, indeed. Hypothesized antecedents and consequences appear in Figure 22.

Insert Figure 22 about here

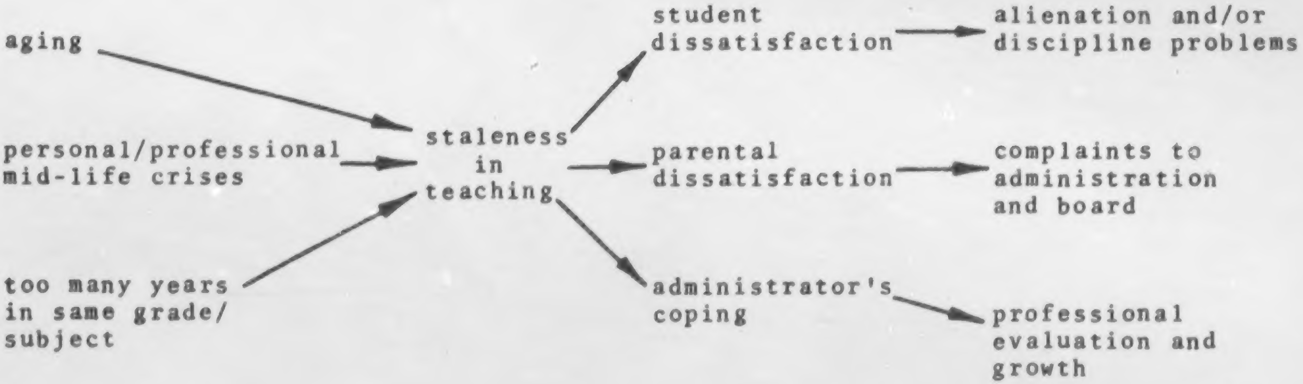
aging
personal/professional mid-life crises
too many years in same grade/ subject
staleness in teaching
student dissatisfaction
parental dissatisfaction
administrator's coping
alienation and/or discipline problems
complaints to administration and board
professional evaluation and growth

Figure 22. A Miniature Theory of "Teacher Staleness"

Analytically, a key issue became, "What can a district do to avoid or remediate the going stale phenomenon?" As the observer was speculating on this, he discovered in the Alte School News, a report of "The Committee to Stimulate Excellence in Teaching," a set of proposals for general staff growth and development. The board of education voted $10,000 to help carry forward the recommendations on mini conference grants, individual career planning grants, cash subsidies to the Alternative High School Program, and "the installation of telephones for teachers in all the district buildings."[46] Figure 23 contains hypotheses regarding the prevention/remediation of staleness which arose in conversations and reflections.

Insert Figure 23 about here

Percentage of Good Teachers

Very early in discussions with parents, administrators, or teachers, no matter how much one tried to talk of general dimensions of science education in the Alte Schools, the conversation would eventually turn to the capabilities and competence of the individual teacher. Characteristically, the thought processes of the parent would come back to a particularly "strong" or "weak" teacher their son or daughter had had in this grade or that in the elementary school. Similarly, departments in the junior and senior high schools would be described in terms of the percentage of strong and weak teachers. Contrasts and comparisons would be drawn by teachers and administrators between Alte and districts in which they had previously worked. Invariably, Alte would come out ahead. No one would speak of teachers who were "really bad" or "shouldn't be in the classroom" as was Miss X or Mr. Y from Blank District whom they'd taught next to before they came to Alte. Usually such individuals in those districts were described as not knowing what they were supposed to teach (e.g., an ex businessman who didn't know math or science content) or who were hostile or vicious in interpersonal relations with the children. At worst in Alte were a few "average" or "mediocre" teachers, in the judgment of most commentators.

For our purposes here, the point is similar to that made about the other dimensions. If science education in a district is to be described and analyzed in a way rich enough and mundane enough to

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[46] This item came up in conversation after conversation with teachers at all levels. It was/is perceived as a major facilitator of the teachers' efforts--especially with home contacts. As the observer was around offices and faculty rooms, the phone seemed in constant use.

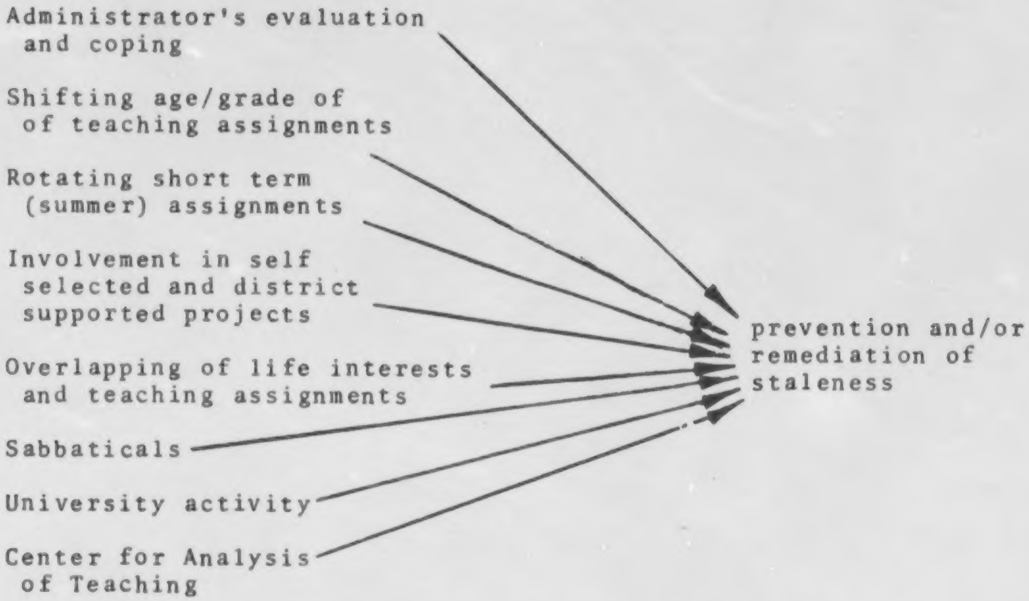
Administrator's evaluation and coping
Shifting age/grade of of teaching assignments
Rotating short term (summer) assignments
Involvement in self selected and district supported projects
Overlapping of life interests and teaching assignments
Sabbaticals
University activity
Center for Analysis of Teaching
prevention and/or remediation of staleness

Figure 23. Preventing and Remediating Staleness

deal with the way participants in the system construe the system, an assessment of something like "the percentage of good teachers in the system" must be made. If we take our proverbial fifty school districts, does Alte have a higher percentage of good teachers than any other district, about as many as the middling district or fewer than most of the fifty districts?

Illustrative of local attempts to do this is the survey, How Citizens View the Alte Schools, cited earlier. Parents were probed:

> Based on what you know, how far up the ladder or how far down the ladder would you rate the job being done by teachers in the public schools?

The citizens with children in the schools responded: Excellent 31%, Above Average 50%, Average 15%, Below Average 2%, Poor 1%, and No Opinion 1%.

From this observer's perspective (Smith 1977), teacher effectiveness or teacher competence is "a complex valuational/ theoretical / empirical judgment." Unless the problem is approached at that level (and not just as a value-free technical problem), it won't be solved. Alte seems to have made a major start in a congruent direction. Of all the "dimensions of science education" discussed in the Alte School District, the "percentage of good teachers" is the most critical one.[47] The assessment and enhancement of that dimension are tasks engaging personnel at all levels in all parts of the district.

Balance/Diversity in Staff

For a number of years, we have been enamoured with the concept of balance/diversity in a school staff. The concept refers to the kind of variety represented in our half dozen vignettes. Presumably, a series of observations/interviews/documents could be used to assess individual teachers in the science education program of fifty schools and judgments could be made regarding the degree of balance/diversity that exists in each school district relative to other districts. At that point, antecedents and consequences could be tested. In Figure 24, we present a miniature theory, a series of interlocked hypotheses, suggested by our data. The degree to which they are true in the broader educational world is open to question and empirical test. That they reflect important issues in the theory and practice of science education seems obvious.

Insert Figure 24 about here

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[47] As mentioned earlier, Alte does not have problems of economic resources, juvenile violence, or racial conflict.

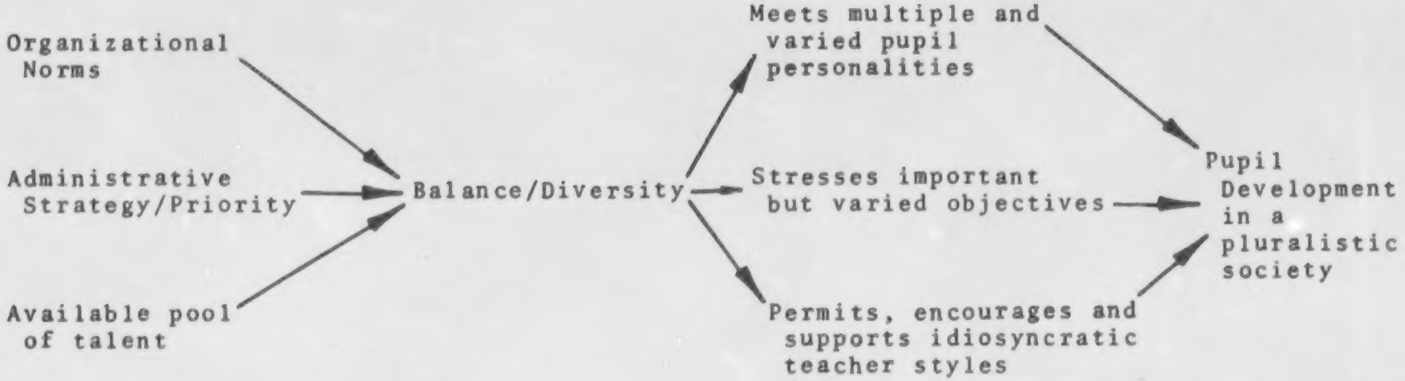
Organizational Norms
Administrative Strategy/Priority
Available pool of talent
Balance/Diversity
Meets multiple and varied pupil personalities
Stresses important but varied objectives
Permits, encourages and supports idiosyncratic teacher styles
Pupil Development in a pluralistic society

Figure 24. Antecedents and Consequences of Staff Balance/Diversity

Centrality of the Teacher in the Classroom

On occasion in observational studies, the presence and recurrence of little items jell into patterns and conceptions of larger significance. Consider, for instance, the presence and recurrence of these items across schools, levels, disciplines, and departments:

1. in most classrooms, a section of the blackboard with assignments for each day of the week;
2. teachers' grade books literally full, cell by cell, of pages of numbers;
3. teachers carrying a stack of laboratory notebooks home to be graded (in the evening) or into class to be returned (in the early morning before school);
4. lab books full of red ink comments;
5. frequent classroom byplay around the question, "Does it count?";
6. reviews before tests, taking of quizzes and tests, returning and checking of tests;
7. in the staff room of one school, the presence of a small test scoring machine for rapid marking of objective tests;
8. long faculty discussions and memos defining "cuts" and "absences," clarifying responsibility among teachers, administrators and clerks; and
9. sitting in offices and staff rooms as teachers talk in detail with parents re a child's work, both its quantity and quality.

Several lines of meaning seem implicit in these items:

1. the teachers play a dominant and influential role in pupil learning;
2. students are expected to learn, assignments are made, products (homework, lab books, tests) are monitored carefully; and
3. points accumulate into semester grades and grades into class ranks.

Further, there is more than a fair congruency in these items and their presumed meanings with (1) the conception of the "good" or "strong" teacher in Alte, and (2) the district-wide conception of excellence in teaching, and (3) the administrative and organizational means of reaching excellence.

Finally and perhaps most importantly, the items can be placed up against two more general positions in the literature. First, in a classical review of classroom questioning, Hoetker and Ahlbrand conclude regarding "the persistence of the recitation":

> The studies that have been reviewed show a remarkable stability of classroom verbal behavior patterns over the last half century, despite the fact that each successive generation of educational thinkers, no matter

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> how else they differed, has condemned the rapid-fire, question-answer pattern of instruction. This opens a number of interesting avenues of inquiry. What is there about the recitation, for instance, that makes it so singularly successful in the evolutionary struggle with other, more highly recommended, methods? That is, what survival needs of teachers are met uniquely by the recitation?
>
> Then there is the question of what seems to be the monumental inefficacy of teacher training institutions in affecting the classroom behavior of teachers. If the recitation is a poor pedagogical method, as most teacher educators long have believed, why have they not been able to deter teachers from using it?
>
> Or, is it not possible that the practicing teachers are right, and the professors unrealistic, and that the recitation--for some reason--is the best pedagogical method? Or the only practicable one for most teachers?
>
> (1969, p. 163)

A most interesting set of questions!

Secondly, there were some deja vu aspects of these elements in teaching. Items from an earlier study, The Complexities of an Urban Classroom (Smith and Geoffrey 1968), kept reappearing. Miniature theories of homework and textbook teaching from that study are presented as Figures 25 and 26.

Insert Figures 25 and 26 about here

The point that is being made is that textbooks and homework abound in Alte and have an array of functions--and some dysfunctions--which Hoetker and Ahlbrand hint at and Smith and Geoffrey hypothesized about.[48] While a lengthy comparison of each element would be necessary, suffice it to say (1) that the "negative consequences" seem less frequent in Alte; and (2) that both texts and homework are embedded in a broader and richer program, as the vignettes and earlier analysis indicate, than the classes in the Washington School. Many of the functions exist nonetheless.

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[48] If we had been onto this issue earlier and if we had had more time, the Smith-Geoffrey models would have made beautiful vehicles for more systematic interviewing.

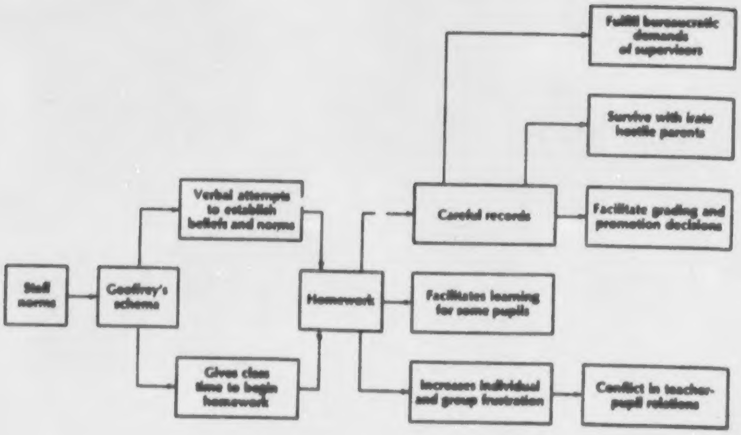

Fulfill bureaucratic demands of supervisors
Survive with irate hostile parents
Verbal attempts to establish beliefs and norms
Careful records
Facilitate grading and promotion decisions
Staff norms
Geoffrey's scheme
Homework
Facilitates learning for some pupils
Gives class time to begin homework
Increases individual and group frustration
Conflict in teacher-pupil relations

Figure 25. Ramifications of Homework as an Activity (from Smith and Geoffrey 1968, p. 182)

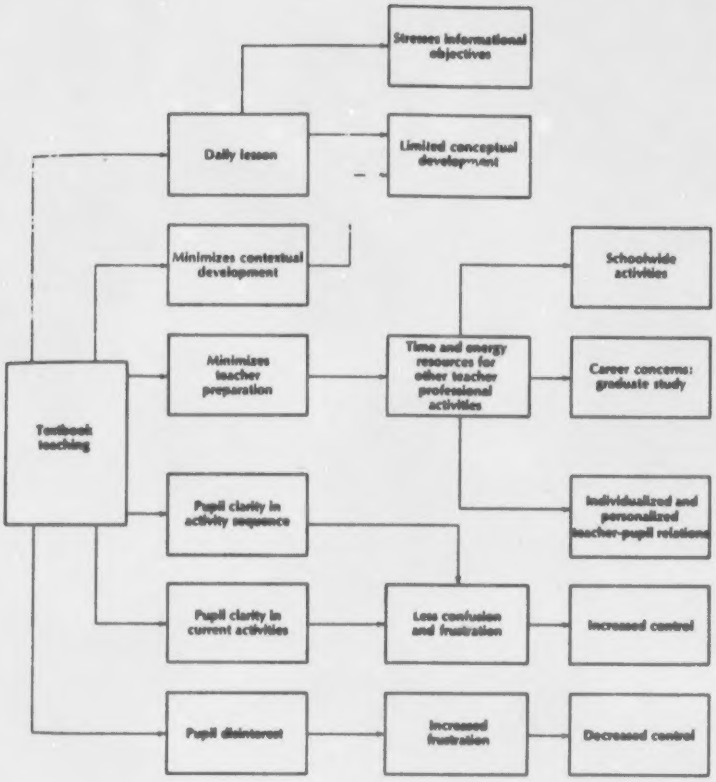

Stresses informational objectives
Daily lesson
Limited conceptual development
Minimizes contextual development
Schoolwide activities
Minimizes teacher preparation
Time and energy resources for other teacher professional activities
Career concerns: graduate study
Textbook teaching
Individualized and personalized teacher-pupil relations
Pupil clarity in activity sequence
Pupil clarity in current activities
Less confusion and frustration
Increased control
Pupil disinterest
Increased frustration
Decreased control

Figure 26. Impact of Textbook Teaching on Aspects of Classroom and School Social Structure and Processes (From Smith and Geoffrey 1968, p. 183)

The accumulating observations and the accumulating interpretative asides suggest a beginning toward an accumulating analysis.

> (Obs - So far, in junior and senior high, most of the math has been text, high demand, digging into it.)

And

> (Obs - Again, if the text is well written, and if the kids plow through it, and if they are bright, much of the outcome will be there. Assume you may lose a little of the specifics, a bit more of the generality and transfer, and a gradual dropping out of interest in math by a couple more kids.)

That this kind of analysis into teaching can be carried further appeared throughout the notes. For instance, in a junior high math class:

> The pupils are all busy on text problems, working independently. She goes to those with questions. Comments. Helps.
>
> (Obs - Teaching in motion
> personalized interaction
> overcoming specific barriers to learning.)

All of which are major concepts from the earlier study (Smith and Geoffrey, 1968) whose subtitle was "toward a general theory of teaching."

In the course of the semester we collected a number of "tests" used in different parts of the curriculum. More systematic accounting of what the pupils are expected to know would have tied down the intellectual substance of science education. We have excerpted into Figure 27 a few items which capture the flavor of some of those expectations. Some are "fun," some involve intellectual skills, some tap developing concepts and some pull quite specific information. All seem tied to the broad goal of academic excellence.

Insert Figure 27 about here

In short, the teachers are central figures in science education at Alte. One might say that Rousseau doesn't live here. The teachers play a vigorous role in classroom interaction. Many are skilled artistic performers. They make strong and high academic demands on the youngsters. Even in a heavily lab-oriented, hands-on experience, the work is guided by textbooks and materials (some of which were written by the Alte staff), implemented through homework of quite varied but demanding sorts, judged in frequent and assorted tests and examinations.

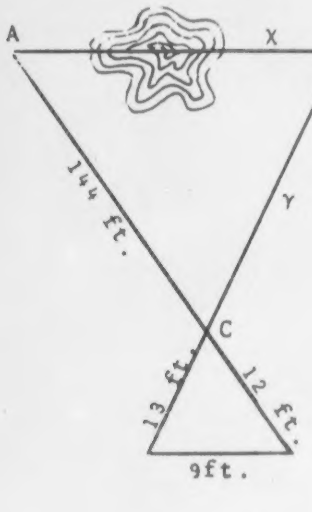
Quantitative Science

1. What is the force with which a three gram cookie strikes a wall while accelerating at a rate of 6 cm/second per second?

2a. What is the weight of a caterpillar as it accelerates at a rate of 4.5 centimeters per second per second along the trail in Olympia National Park. The mass of the caterpillar is 50 grams.

2b. What force would it take to accelerate the caterpillar over a carpet of bryophytes (moss) at a rate of 2.3 ft/sec/sec?

Junior High Math



A bridge will be built from A to B.

1 Solve this proportion to find its length.

$\frac{X}{9} = \frac{144}{12}$ X = ______ feet

2 Complete and solve this proportion to find the distance from B to C.

$\frac{Y}{13}$ = ______ Y = ______ feet

Figure 27. On Being Tested in Alte

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A Center for the Analysis of Teaching: A Community Resource

This long account of teaching--its excitements and its problems--leaves one with questions of implications and recommendations. After many hours of observing and talking with teachers and many hours of talking with administrators, parents, board members, and university colleagues, many of the ideas coalesced into what might be called a Center for the Analysis of Teaching. The idea is intended to be neither presumptuous nor patronizing. Actually it grows out of several concerns, perhaps the most basic that much of the university's contribution to the public schools is limited and ineffectual.[49] The idea comes, in part, from teachers who have reputations as being "strong teachers," as revealed in such simple comments as "I need to get out of my rut," to the more complex "I was in a depression for six months after that 'educational' experience." They seem to be looking for kinds of resources and experiences that are rarely provided for in public schools, even those as well endowed as Alte.

And finally, the idea springs from the questions of administrators and citizens: "What do you do with a Miss X or Mr. Y who has lost interest, lost touch with the subject and/or the kids, who is just putting in his/her time?" As they talk about their efforts to overcome what we have called staleness, they have been stymied, even in a metropolitan area that boasts a half dozen institutions of higher education and an array of other cultural and intellectual resources.

The initial structure and agenda of such a Center would follow from a combination of a relatively simple set of assumptions and a statement of the manifest and latent issues and observations in Alte. First the assumptions:

1. It would be an organizational instance of what Atkin (1972) has called "practice based inquiry." While it would be a service-oriented facility, it would have a commitment to this blend of clinical research.
2. It would be attached to or located within a university.
3. It would begin small to see if it could make demonstrable contributions to individual teachers, schools, and districts.

The initial agenda follows simply upon the major parts of this analysis:

1. In-depth investigation of teaching styles we have described earlier. Bringing to bear intensive qualitative observation,

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[49] At one level this can be taken as a personal view of one observer/analyst in a particular education department of a particular university. The degree to which anyone else believes the same is an empirical issue.

intensive interviews, careful video recording of long sequences of classroom interaction toward an analysis of learnable/teachable aspects. In a sense, doing for teaching what Bloom and Broder (1951) initiated in problem solving.

2. Becoming a referral source for "teachers with teaching problems." In effect, providing a back-up facility for both diagnosis and retraining, patterned in part after the supervisory model of evaluation but with the resources to carry out more intensive long-term analysis and training. Some of this might be handled in a course on the analysis of teaching. Mostly, the impact would come from an "individualized case approach." Once again, I'm reminded of psycho-educational clinics working with children with reading or arithmetic problems or medical clinics working with specialized medical problems. In part, the clientele would be self-referrals; in part, school or district referrals.

3. Short term individualized analysis, discussion, and change in teaching. In every school, the observer ran into teachers who wanted to "talk teaching." By this is meant they wanted to show him something they did (which often was well done), have him react to it, argue about it in the best sense of exploring its latent nature and implications. Again, from the observer's point of view one of the most frustrating parts of the research was the continuous pull to spend long periods of time in classes of individual teachers, engage in lengthy "interview/discussions," attempt to understand them, their situation, their theory of teaching, both espoused and in use. The observer wanted to establish relationships of the order of those he had made on other occasions, e.g., Smith and Geoffrey (1968), Smith and Brock (1970, in press).

4, For those teachers whose content knowledge has become dated or whose teaching assignment has shifted substantially, and who have the possibility of extended summer work or a semester or year sabbatical, the tailoring of a more formal program of study. Our observations of several instances of this suggest that in a district such as Alte it's not so simple an event as a course here or there. Each of the schools has its own ethos, its own context. Retooling in elementary math or social studies, for instance, may require work in the teaching of reading because reading is the sine qua non of success in the elementary school. Similarly, changes in high school science or social studies may be implicitly but fundamentally linked with mathematics or literature or history. A Center for the Analysis of Teaching would have to have resource alternatives to expedite major program planning within and across disciplines.

5. One teacher, in thinking about the issue, outlined a brief proposal. It is reproduced verbatim.

TEACHER-LEARNER: A Proposal for NSF for a "New Kind of Sabbatical"

I. The teacher would serve as a teacher for the academic year within the district but carry only half the teaching load. The other half of his/her time would be spent in an academic pursuit as described in the projects listed below and the projects would be run in cooperation with a university.

The NSF would pay the district the amount of one half of the teacher's salary and absorb the university cost and supply a consultant for each project who would make at least two site visits. The NSF would publish annually the final reports of all projects.

II. The projects would involve the teacher--the district--a university--and the NSF. All projects would be initiated by the teacher except F as listed below. The application would be submitted by the teacher and district jointly.

III. Types of Projects.

A. Writing new curricular materials
B. Implementing a new curriculum
C. Writing a research paper on a particular topic
D. Investigating and applying learning theories
E. Executing an educational research experiment
F. Apprenticing to a master teacher (This one would be initiated by the district in an effort to help a teacher improve his style. No district could apply for this until it had had one of the above.)
G. Retrain

IV. University involvement

The teacher is too often isolated within the classroom, and this proposal addresses itself to this problem in two ways. Hence, an integral part of the proposal is the involvement of an individual or team from a college or university who would work with the teacher in defining the problem, executing and writing the report. The teacher would be given free access to libraries, herberium, etc.

V. Special considerations for rural teachers

   A. Travel allowance to a university
   B. Reduce class load by only two classes, but free one day per week for travel to the university

VI. NSF Consultant

The consultant is a helper who will visit the site at least twice and serve the following functions:

   A. Active, sympathetic listener
   B. Expediter to handle red tape in NSF/district/university
   C. Resource person, such as getting copies of documents from L of C, or providing references of similar projects, etc.
   D. Editor

In summary, the observer was immensely impressed with the idiosyncratic styles of teaching exhibited by a large number of Alte's teachers. He was privy to the concerns voiced by others--some of which were major professional life crises. In some instances, he observed teachers who he felt, and others corroborated, had gone stale or burned out. In perhaps too quick an extrapolation, it seemed that organizations such as NSF and the universities might make more of a contribution than they have to those issues. A Center for the Analysis of Teaching is one simple thought in that direction. Several Alte teachers agreed.

AREAS OF CONTROVERSY

Within the Alte Schools several areas of major controversy exist. Mostly they impinge upon "science education" rather than being central to it; consequently, the discussion here will be brief. IPI math, Individually Prescribed Instruction in elementary mathematics, is the curricular issue most in contention in science education. That has been considered at length already. Several other issues are worthy of mention: teaching average ability youngsters, "the silent majority" as it is sometimes called in Alte, and the "A School," the alternative high school. Finally, there are some interesting differences of opinion regarding resources.

Teaching the "Silent Majority"

In a college prep high school where 90% of the students go to college, where excellence is the overriding goal and where increasing specialization of knowledge is the primary means to the goal, the average student, sometimes called "the silent majority," can become lost. Multiple conversations, and multiple reports of summer curriculum development projects investigating curriculum and teaching for average pupils and slower learners,[50] attest to the presence of the problem and the continuing struggle to do something about it in science, math, and social studies.

Actually, the labels are used inconsistently and "silent majority" is a misnomer for the overwhelming majority of the high school students are in a college prep curriculum and do go to college. It's almost as though that group is broken into those who are the most able, who are in honors sections of the high school ("Alte U") and who will eventually attend prestigious eastern colleges and technical universities (e.g., engineering schools), and those who will attend other colleges. The strangeness of this was caught by one of the site visitors.

> In the slow algebra class, 12 students actively participated with the teacher in analyzing quadratic equations, while three students looked out the window, or kept their heads on their desks. I was impressed with how quickly the 12 learned the algorithm, and was startled with the realization that in many schools these children would have been academic super stars.

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[50] On test scores Alte's "slow learners" are average and above on national norms, below average on local norms. The situation is a far cry from tested abilities reported in The Complexities of an Urban Classroom where only three out of 27 youngsters tested above 100 on group intelligence tests.

Another site visitor, after a conversation with one of the science teachers, commented in the report:

> The teacher expressed concern that the courses in the science area at Alte High were too difficult for some students in the school. . . . said that the entire curriculum was designed to make the student think critically. Some could not. There was nothing for these students. [The teacher] felt that something should be done for these students . . . hoped to change this. . . .

Such are the perspectives of two visitors who each spent a day in the Alte Schools.

As indicated earlier, the curriculum in math and science is tracked in terms of prerequisites which have ability and interest criteria. This produces a fair degree of homogeneity in the classes, though less so in the history courses, which tend to have a more broadly based clientele. It produces, though, as the summer curriculum reports attest, the continuing problem and frustration of "what to do with the average and lower ability students." In the day-to-day classroom situation, the multiple excerpts from class protocols scattered through the report suggest aspects of the problem and attempts to cope with it.

While in no way trying to present a solution to that problem, the observer, one day in early May, after watching two beautiful lessons, one (X) with a high ability science class and one (Y) with an average ability class, reflected at some length in the notes.[51]

> (Obs - There's a major difference running through the teaching as I contrast X and Y. Hard to pin down--
> 1. both are on task
> 2. both are helpful - with individuals and total group
> 3. both want kids to learn
> 4. difference in level of difficulty [ideas, vocab, etc.]
>   in pace - one explanation vs. multiple explanations, one problem vs. multiple problems, one illustration vs. multiple illustrations
>   in one (Y) more a teacher than scientist

[The observer broke in with an interpretive aside within this broad interpretive attempt to compare and contrast.

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[51] Once again, we are illustrating, methodologically, Atkin's (1973) argument for practice-oriented inquiry. The more intense analyses of the latent implications remain to be spelled out and synthesized with similar approaches in the literature, e.g., Bloom and Broder (1950).

(Obs - More like undergraduate teaching, general education,[52] vs graduate and professional instruction at W.U.)]

5. difference in bounding of units
   a. one (Y) is more common sense and in world-at-large
   b. other (X) is bounded more by scientists' categories
   c. one (Y) is related to things one can do in the world - practical projects.)

In short, the point is that "solutions" for working with the silent majority exist in Alte, in another kind of silent majority, a group of teachers, many of whom tend to be less visible and less legendary than some of their colleagues. Exploring for, communicating about and rewarding those individuals, those teaching strategies, and those settings seems a worthy agenda item for the District and perhaps implicitly for the structure we called earlier a Center for the Analysis of Teaching.

The "A School"

The Alternative High School has been in existence five years. Describing and analyzing it is like trying to clutch a phantom. It is an evolving and changing phenomenon, system, entity. Briefly, when it began several key items were noted:[53]

1. Student initiative was a major factor in its origination.
2. The Alte School News reported: "The request (to the Board) was prompted, the committee reported, because a significant number of students, both academically able and those with problems, have expressed a desire to 'drop out' unless something broader and more immediate as an alternative is offered."
3. An initial maximum size limitation of 5% of the high school population was instituted and has been maintained.
4. The program was to "complement" the regular program.
5. The program of the regular high school was felt by the committee to be "efficient and effective" for the majority of students; but they agreed it was "monolithic and offers only one set of assumptions about learning and that a second choice should be provided students."

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[52] It's been a long time since the observer read the Harvard report on general education. Time prohibited returning to that and similar sources and building them into the analysis.

[53] Most of these items are from several issues of the Alte School News.

6. The typical day involved such items as "advisory meeting with counselor, independent options, mini-courses (creative writing, film viewing, contemporary music, Yoga, photography, comparative religion, and nutrition), group dynamics, team project, town meeting, and school project."
7. In the first year the faculty was one full-time teacher and several part-time teachers from the high school.

From those initial characteristics the school has evolved substantially. Currently, there are three full-time faculty, some forty-five students, and an evolving program of studies. An examination of several of the major curriculum thrusts places the program into science and social studies in several interdependent ways. Several strands might be considered:

1. community ideology of the A School, town meetings, values classes
2. community study - history and ecology of a town whose nearby river is to be/may be dammed
3. multifaceted science study - plants, ornithology, Nature Lodge at the sixth grade camp
4. science, poetry, and writing

Briefly, one of the major educational experiences at the Alternative School is the Wednesday morning town meeting. The students and faculty jointly decide the school goals, program, and even who will be accepted in the subsequent year. The more controversial issues which defy solution for the moment are referred to the "values class" taught by an instructor with background in psychology and social science. These discussions are mixed with a variety of activities, exercises, and readings geared toward self-understanding and understanding of others. Much of this fits the contemporary perspective of humanistic psychology. In a sense it's "hands on" social science, in part generated out of real experiences in the day-to-day functioning of the school, and, in part, feeding back into the system. It tends to be more oral and less bookish, more immediate and practical and less remote and theoretical, more group involved and less individualistic than social science at the high school.[54]

One of the larger projects involves a mix of history, social science, science, and language arts. A community study is underway regarding a town which is near a river whose proposed damming is under considerable controversy--locally, statewide, and nationally (e.g., President Carter's current proposals on waterways).

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[54] At this point, there is no intent to argue "better or worse" regarding either end of these continua, only to indicate there are substantial differences between classes at the A School and at Alte High School.

Contacts have been made with community leaders, interviews are being collected (a mix of oral history and survey research), documents are being read, nature studies are being undertaken, and a log cabin in the area is being restored. The product is to be a "magazine"--a report with feature articles, essays, poetry, and pictures. A broad attempt to integrate with language arts and communication.

Finally, brief mention might be made of a host of science activities. The observer heard a good bit about and saw the massive notebook product of a science, art, and literature project, a one-afternoon-a-week for ten weeks journey to an arboretum. Observation, discussion, sketching, and poetry writing produced some exciting results. The affect generated was a major force in the school. Parents commented about both the quality and quantity of the work accomplished by their sons and daughters. This year, week-long stays at the cabin in arboretum have been implemented for pairs of students. Nature observations are recorded through the seasons. Keeping the cabin warm, preparing meals, and living together have been major "curricular items." Other groups have done extensive camping, bird watching, and visiting at conservation centers, swamps, and field stations around the midwest. A course in "plants"--their propagation, growth, and economics (spring sale at the High School)--has involved others. Scraping and tanning deer and coyote hides took the time and efforts of others. Comments were made earlier about the Nature Lodge which was set up at the sixth grade camp.

The most fundamental differences in this kind of science curriculum and that provided elsewhere in the district seemed to be in two dimensions. The hands-on quality here tended to be with problems more of the students' own choosing, although the instructor was involved heavily in discussions which sharpened, clarified, and helped shape the problems. The problems were "more real"; that is, they grew out of ordinary, practical, or everyday experience rather than from more of a theoretical context. Once again, no attempt is made here to argue "better or worse," but rather to pinpoint clearly differences and similarities.[55]

To round out "science education" at the Alternative School, the math tended to be more practical also--essentially basic arithmetic. In one lesson which was observed, the content was a cluster of problems in fractions and decimals taken from a study guide for the G.E.D. tests. The procedures and discussions were not too different from what one might find in many elementary or junior high classes. The students seem to find them more than difficult enough.

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[55] At several points we have tried to indicate the complex valuational/theoretical/empirical analysis needed to judge whether this is "good" or "better" education.

Current opinion of the Alternative School by faculty at the regular high school, and more generally in the Alte Schools and in the Alte community at large, is mixed.[56] Parents of students attending the school are reported to be supportive. In most instances they are pleased to have a school setting which their youngsters aren't resisting. For, in turn, they don't have a daily hassle with them regarding attendance. The importance of this is self-evident to anyone who has been through this experience or who's had close friends or relatives who have.

The mixed feelings of the Alte faculty are attested to from a variety of sources. The high school curriculum guide, for instance, does not contain any reference to the "A" School; recruiting for the school does occur visibly (e.g., signs posted in the corridors) and is supported by the administration. Comments by teachers in committee meetings, "They are a part of Alte High," carry a flavor of implicit separateness and/or exclusion. In turn, the A School faculty sees itself as apart from, and sometimes hostile toward, the regular faculty. The Alternative School students are explicitly negative toward Alte High School. The stuck-up youngsters, the boring curriculum, the domineering faculty, the punitive administration and the general lack of freedom for doing one's own thing are recurring reactions in the school.

At this point, this observer/analyst neither wants to take sides, for the issues are much wider than science education, nor is able to take sides, for the data are too limited. Several final observations, hunches, and speculations might be in order. First, some irony exists in that the formation of the A School was entangled with the Committee to Stimulate Excellence in Teaching.[57] As reported in the Alte School News:

> Two of the budgeted activities are subsidies for innovative programs inaugurated this fall at Alte High School [the Alternative High School] and Alte Elementary School. The committee felt that these programs will have a stimulating effect on the entire staff, whether through the techniques or programs developed at these schools or through teacher-initiated activities as a result of the activities at these schools.

This has not happened between the Alternative High School and Alte High School.

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[56] In part this may be a function of our limited data, of what year of the school the faculty member has knowledge, and the degree of direct personal knowledge possessed by the faculty members. All of this suggests the importance of a careful study of the school: historically, contemporaneously, and through a follow up of former students and faculty.

[57] Our data here are not complete enough to unravel the complexities of the story.

Secondly, much of the discussion and exchange of epithets with and about the A School seems beside the point, e.g., cop out, dropout, spaced out, and so forth vs boring, regimented, authoritarian. The underlying fundamental issue, in this observer/analyst's speculative view, is that the A School represents a fundamental critique of the core values, e.g., excellence as specialized knowledge, and the central procedures, e.g., high-demand, teacher-structured courses and classes of Alte High School, as well as of the relationship between that kind of school and the larger society of which the community of Alte is representative.

But those speculations--right, wrong, or confused--are apart from the more restricted scope of this report. Suffice it to say that some students were unhappy enough at Alte to want something different as their secondary education. The community, through the faculty, administration, and school board, were responsive to those wishes in helping to create an alternative school in which some percentage (and here the figures vary) of the forty to forty-five youngsters are experiencing, among other things, some very novel approaches to science education.

Resources and Their Use

One of the initial, impressive, and almost overwhelming aspects of the Alte School District is its resources. It begins, as has been indicated, with the upper middle class community with its high assessed property base and taxes. The district's per pupil expenditures are in the top ten percent locally and higher statewide and nationally. Such financial resources are converted into low teacher-pupil ratios, materials and supplies (e.g., LRC's), ample physical space, and a variety of pleasant and satisfying working conditions.

An illustration of the working conditions appeared in the field notes:

> I've been out for coffee (10¢/cup) and donuts (brought in by one of the teachers). Teachers' room is air conditioned. Prints of Picasso and Miro are on the walls.[58] Facilities include a lavatory, sink, stove, refrigerator, coffee pots, lunch tables shoved together as one big table. Sofa, chairs, and table for lounge area. Very comfortable.

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[58] While this investigation centered on science education, an equally interesting study could be made of aesthetic education. The prints are reminiscent of the high end of Toffler's (1974) and McLean's (1975) positions. See our discussion in Smith (1977).

In the course of being a participant, the observer kept meeting and being impressed with the personnel called aides, clerks, and volunteers. Brief comments were recorded in the notes.

> Brief conversation with Mrs. Jones. She's a parent with kids at another elementary school in Alte. Had done volunteer work. A friend of one of the teachers. Got on as "clerk." She's a bright, charming, competent woman. Enjoys the kids, the work, the group of adults. (Obs - Another resolution for putting meaning into one's life?) Other aides hired more directly through central office applications. She has not been trained as a teacher.)

The additional strength this brings to the district seems very great. It warrants a separate analysis in its own right.

The material supplies were overwhelming--in the eyes of the observer. One of his academic biases is toward the availability of books of all kinds. To find each elementary school library with five to ten thousand books seemed an unheard of resource. The junior high library with microfilm and microfiche readers and complete sets of the morning and evening metropolitan papers seemed equally astounding. In addition, the elementary LRC's were full of science boxes, math games, social studies materials of multiple kinds--not to mention language labs, spelling materials, and SRA individualized reading sets.

A careful study of the utilization of the materials and facilities was not made. Our "in and out" research style left us with several impressions. The elementary LRC's usage varies some across schools, but generally they hum with activity. The junior high library seemed much less "busy" when the observer was in to write notes between classes or after observations. The high school library was jammed, and according to several teachers, was a facsimile of a student union. The firmness of those comments as generalizations is open to question. The antecedents and consequences are even more provocative.

The most interesting and controversial implication arose in comments from teachers and administrators early in the study. The observer commented on several occasions about "being overwhelmed" regarding the resources. This led to comments of multiple sorts from the Alte staff member. Several staff members, as the discussion proceeded, raised some doubts about the "over abundance" of materials and the twin consequences--inhibited teacher creativity and fostered staff individualism and lack of joint activity. In turn, the observer/analyst speculated about the possible curvilinear hypothesis between amount of resources and teacher creativity and cooperation. Later, other staff members were highly critical of the validity of the hypothesis. Finding unobtrusive measures of resource utilization, of teacher creativity, of faculty cooperation and competition, and of teacher belief systems (e.g., "I can't do this because..."), interrelating them within and across districts, and looking for antecedents and consequences seems a problem worthy of further inquiry.

Conclusion

While these "areas of controversy" exist in Alte, it should be obvious that they are neither overwhelming nor the focus of bitter conflict. In this investigator's opinion they are part of the give and take within and among the major groups within the district. As the district copes with the problems of education, the sides line up and regroup from issue to issue. The larger impression is that of agreement on most things.

TOWARD A SUMMARY AND CONCLUSION

An Overview

At the close of a study, it is often useful to sit back and ask--What has been learned from the effort? For an educational psychologist, that has a certain ironic reflexive quality. Implicitly, it asks for one's concept of learning, how is one different now from before? Essentially it seems to be that cognitive structures are altered in these several ways:[59]

1. a few specific new ideas or elements
2. some finer discriminations in the network of relationships--both hierarchical and causal
3. alterations in the overall integration of the domain of inquiry, i.e., science education in a school district
4. some shift in emphasis, importance, or centrality of particular parts--"bright, bold strands"
5. some pieces isolated more clearly as problems, puzzlements, questions.

The next few pages will review particular substantive issues which seem to fit one or more of these changes. The ideas have their precursors, they are part of an evolving point of view. In a sense, they are personalistic and couched in the form of what the observer/analyst learned. By being grouded in the particulars of science education in the Alte School District and in some more general literature in education and social science, it is hoped that the learnings might be instructive for several audiences--colleagues in Alte, in the CSSE project, in science education, and in professional education more generally.

Tentative Thoughts About An Historical Perspective

The historical perspective on the district's science education program has seemed particularly instructive, even if only partially developed. To see--in the 1890s --that most of the elements, structures, and processes were present in embryonic or rudimentary form may be too obvious to everyone to be called an insightful perception or conclusion. However, the implications sprout in a dozen different ways. What was the direct and indirect influence of the report of the Committee of Ten (1893) on the Alte community and staff at the turn of the century when they began to think about the high school program? What was the impact of the bulletins from the State Departments of Education in the midwest and elsewhere, such as Organization and Administration of Junior and Senior High Schools (Lee 1927)? Was Alte a recipient or was it among "a number of superintendents, principals, and teachers [who] rendered valuable assistance" in the preparation of such statements of standards? Are national and state committees and their pronouncements more or less influential now than fifty or one hundred years ago?

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[59] Methodologically this has implications on the classical problems of the purposes of research, foreshadowed problems, investigator bias (seeing what one wants to see), criteria for evidence, replicability, generalizability of case study findings, and so forth.

The historical perspective can lead also to a fundamental reworking of one's approach to the very nature of knowledge. Reading Toulmin's and Goodfield's triad of books on the history of science, Architecture of Matter, Fabric of the Heavens, and especially The Discovery of Time, in anticipation of the project was both provocative and unsettling in terms of specific ideas and conceptions in "science" and also in the investigator's own conceptions of social science as it related to CSSE. In the Preface to a later book, Toulmin (1971) expressed it this way.

> The central thesis of the present volume...can be summed up in a single, deeply held conviction: that, in science and philosophy alike, an exclusive preoccupation with logical systematicity has been destructive of both historical understanding and rational criticism. Men demonstrate their rationality, not by ordering their concepts and beliefs in tidy formal structurals, but by their preparedness to respond to novel situations with open minds--acknowledging the shortcomings of their former procedures and moving beyond them. Here again the key notions are 'adaptation' and 'demand' rather than 'form' and 'validity'... The philosophical agenda proposed here sets aside all such assumptions in favor of patterns of analysis which are at once more historical, more empirical and more pragmatic.
>
> (1971, pp vii and viii)

His point of view is a large agenda, indeed. It leaves one feeling more than a bit presumptuous.

People and organizations who want to change other people and organizations should know where the people and organizations have come from, how they are currently structured, and where they want to go. The zoning of parts of Alte into 1 1/2-3 acre lots sixty years ago is a chronicled fact. The interpretations that this led to "executive city" or to the current upper middle class quality of the community and the emphasis on educational excellence is overly simple and open to question. The relevance of this to policy groups such as NSF or NIE and to more local immediate "change agents," however, does seem very great. Similarly Alte's conception of the good teacher is phrased colloquially as the "strong teacher," a person with clear goals for children's learning, high demands, and imaginative ways to get there. Such a normative structure has been developing a long time, as far as could be ascertained, and is the product or resolution of a number of contending views. It, like many other positions, is not to be "given up" easily.

A Paradigm of District Structure and Process

Some years ago a perceptive social scientist argued that one should focus one's observations on conflict, not for its obvious sensational properties but rather for its proclivity in bringing to the fore latent structures and processes. The description and analysis of IPI and the LRC's seemed to do that very well. The concluding metaphor is that:

> a school district is a quasi-stationary social system (equilibrium?) of contending individuals and groups with different agendas, points of view, domains of interest, and power.

That may not be "news" either, although a review of texts in educational administration and organizations might be revealing. The full implications of the position are not clear, but several suggest themselves, mostly in the form of "A school district is not just. . . ."

For instance, the Alte District is not just

1. a political system--although it is assuredly that in some respects;
2. a formal organization with agreed upon objectives and rational means to reach those, although there are elements of that, too;
3. a community of scholars, although it has many scholars (both faculty and students) who do live together reasonably well (with a few notable exceptions);
4. a coercive institution, even though pupils are required by law to be there; nor totally a remunerative organization, even though teachers are paid to be there;
5. a learning system of inputs, throughputs and outputs, although pupils do arrive at five years, leave at 18, and in the interim learn well, by most criteria;
6. a professional society, even though the faculty and administrators are very much professionals in the best sense of that term;
7. a mechanical system of replaceable parts and pieces, although incumbent teachers do fill certain positions that will remain after they leave;
8. an organic system that grows through God's help and some simple human nurturance; and
9. a legal system, although the district is enmeshed in federal, state, and local laws.

In effect, we are arguing for a point of view of a system of self-determining actors with individual points of view, prevailing interests, and patterns of talents who coalesce into factions and subgroups around issues of the moment. Each of the "nothing buts" is an important but partial way of stating the general position. Further, we are saying that many of the facets of science education in Alte, and perhaps in some other places, cannot be understood nor explained without such a paradigm.

Nature of Science Education

Some images desert one very quickly, others remain vivid and bold. The afternoon the teacher said that"NSF may view science education as math, science, and social studies, but no one in Alte does"is one that has remained. It may be practical for NSF's national policy and legislative purposes to construe science education that way (and perhaps Congress wrote the enabling laws based on such a conception); but other people and organizations, such as Alte, hold different conceptions and solve their problems, for better or worse, with those alternative conceptions.

Substantively and organizationally math, science, and social studies were separate entities in the junior and senior high schools. In the elementary schools this was partially true, for on some occasions project activities brought a reconstruction of knowledge boundaries. These facts played all through the report and the accompanying interpretations. There is no monolithic science education in this district. Neither Hempel nor his heirs live in Alte.

Curriculum: Domains and Dimensions

Early on, an attempt was made to focus "at the district level"; that is, with the district as the unit of analysis rather than at the school or the classroom level of analysis. The guiding, if not telling, questions were: How has the district changed over the years? and, How can one compare one school district, Alte, with fifty other school districts? While one eye was always wandering, the central view was always on science education--as defined by NSF. As the data from documents, conversations/interviews, and qualitative observation accumulated, the patterns which emerged we came to call curricular domains and dimensions. The domains were large chunks--formal curriculum, informal/enriched curriculum, and curriculum-as-what-is-taught. The dimensions included such concerns as excellence, advanced specialization, breadth, and interrelatedness.

These ideas opened up a series of issues. Several remained, for lack of time, nagging puzzlements. We could not make Bernstein's (1971) provocative concepts of codes, classification, and framing work. Whether the mode of thought is different, whether the concepts are at root tangled, or whether we just did not understand them is not clear. For sure, time was not available for the analysis and synthesis necessary. Similarly a long standing concern for measurement procedures in education vies with the qualitative thrust of our current participant observational mode of inquiry. The insight into the parallelism between our CSSE efforts and the "Evaluative Criteria" came too late to do more than suggest the possible fruits from a careful analysis of that instrument, its underlying theory, and the available empirical data growing from the tradition. We did not have the time to search, codify, and criticize that literature.

The Individual Teacher: Sine qua non of Science Education

This project did not begin nor end as a study of the idiosyncratic teacher. The observer was dazzled by a number of teachers, lessons, and classrooms, only a few of which are recounted in this report. Further, as he sought general dimensions of science education, the people of Alte--administrators, board members, teachers, pupils--always ended up talking about individual teachers. Usually these were categorized into a large minority who were intellectually imaginative, exciting, and creative and usually humane but sometimes egotistical and prima donnaish. An early summary observation and interpretation phrased it thus:

> One isn't in the district long before one hears the names of particular teachers mentioned by other teachers in staff rooms, by administrators and by parents. This seemed an interesting twist on the isolation, the autonomy-equality patterns discussed in some of the literature. I was first struck by this when the names of elementary teachers were mentioned across buildings--"S/he is doing a lot of that," or "S/he is kind of the district expert on that" or "S/he started that in the district." In the junior and senior high schools the same phenomenon occurred, but often with quite visible symbols. "S/he won the 'teacher of the year' awards from this or that state or local group." "His/her kids made 5's on the AP tests." "S/he's particularly good with average kids." And "His/her kids are always coming back with grins and thanks for what they've learned and how helpful their class was." And "S/he is teaching at X College or in Y summer institute."

At the other extreme were a smaller group who were perceived as stale, uninteresting, dull, burned out. Without solicitation, and independently from different individuals in different schools and positions and from different parts of town, the same names in the same categories would come up. The agreement was surprising. Perhaps, as some argued, Alte is a small district. Perhaps reputations are a kind of stereotype. Perhaps, as has been argued in the analysis, Alte has some agreement, a set of norms regarding the nature of the good teacher. Further, Alte has a number of public and semi-public events when a teacher and "what s/he can do with children" are on display. Recall, for instance, the sixth grade camp with several dozen staff members--teachers and administrators from every school in the district, from most of the subject matter areas and with a sprinkling of aides, secretaries, and central office personnel. And an unsolicited comment later while having coffee in the faculty lounge at one of the schools: "She's a hard act to follow." This is not to mention field trips, district-wide art fairs, and spring PTA festivals.

The possibilities for theoretical and empirical analysis of the idiosyncratic teacher arose throughout the project and throughout this report. Like many good problems it is a chestnut. With exemplars as vivid as some of the teachers in Alte, with organizational structures such as the proposed Center, and with the multi methods of observation, clinical method, and practice- oriented inquiry, the chestnut seems amenable to another round of roasting. That is a major problem.

Items of Debate

The Alte School District is an intellectually stimulating place to be. The areas of controversy, except for IPI, seem to flow around, and mostly by, science education. We were tantalized by the hypothesized curvilinear relationship between resources and teacher creativity. So few places are as well off economically as Alte that seldom does an opportunity exist for thinking in those terms. If it is more generally true, it would become an interesting item in the cognitive structure of an administrator as he works with his department, his school or his district. The continuous coping with youngsters of average ability is a story with a long history in Alte and one whose ending has not been written. We kept seeing partial resolutions, some of which have been noted. Those are difficult to communicate, are susceptible to the erroneous reaction ("I'm already doing that"), and seldom seemed clearly perceived and discussed by larger groups of the staff. The Alternative High School is more a splinter under the thumb nail than a stimulus for excellence on the entire staff, which some of the early visionaries hoped for.

Concluding the Conclusion

In concluding the conclusion, one might note the items mentioned earlier. In this investigator's opinion, one should learn something from research; that is, one's cognitive structure should be altered. Further, one of the changes should be an alerting of oneself to novel problems and their solutions. The array of observations and interviews produced a host of images of idiosyncratic efforts at science teaching and glimpses of the complex three dimensional personalities from which these arise. Clarifying those relationships and clarifying the intricate logic of altering those relationships seems the most fundamental issue, the next and most important foreshadowed problem raised by the present inquiry.

APPENDIX I

Methodological Notes: Some Premises of Procedures

Time ran out on this methodological appendix. Instead of a coherent integrated essay addressing the special issues of the CSSE experience as it relates to and extends our previous case study procedures, this is a collection of snippets, ideas born but not developed.

Origins of a project

Research strategy and tactics have complex roots and origins. As one goes back to old notes one encounters numerous forgotten items. For instance, in the fall semester before the project formally began, the observer visited a former student, now a junior high principal in New Suburbia, a middle-middle class district, and he also participated in a three-day Northcentral evaluation of a local high school. Figure A-1 is an outline of notes made then, three months before the case study officially began. Eight months later, in the middle of analysis and writing, idea number one, data sources, was well implemented. Number two, local and national standards, was finessed in the sense of the localist emphasis and the science education emphasis. The interdependency of local, state, and national goals was too big and broad a target. Item three, cross district observations, went the way of limited time. However it was indirectly implemented in that a major question for the site visiting teams was always, "How do you see Alte in the context of fifty other districts or schools in which you've spent time?" Comparison groups can be generated in multiple ways.

Insert Figure A-1 about here

The major points, however, are: (1) the research begins before "the project" begins. To neglect this, not to keep notes from this "real" beginning, is to lose foreshadowed problems and procedural tactics; (2) Sources of stimulation arise in all kinds of experiences and activities. To ignore these is to lose some of one's potential creativity and originality; (3) All this is a restatement and partial extension of Glaser and Strauss' (1967) discussion of theoretical sensitivity.

Choice of Alte

The Alte School District was chosen for two sets of reasons--one substantive to the project and one personal to the investigator.

1. Data and documents that would be helpful re CSSE Project
    1. North Central reports--especially over time
    2. Local histories of community and school
    3. Yearbooks
    4. Documents for parents and kids

2. Major foreshadowed problem lies in
    1. local goals and standards and national goals and standards, that is, "judge in terms of own goals"
    2. the chance to think this one through in a specific discipline and a specific community

3. Tactics in studying Alte might involve lesser visits to nearby districts
    1. District X
    2. District Y
    3. District Z

Figure A-1. Verbatim items from field notes "before" CSSE study began (10/5)

Substantively, it is a small, upper middle class suburban school district with a reputation for having a good science education program. We coded it as Alte because it was an older suburb (i.e., Altevorstadt). As such it fits the larger perspective of the ten sites of CSSE wherein categories of urban/rural/suburban, large/middle/small, regional (north/south, east/west/middle west), lower/middle/upper middle class districts have been relevant to the choices.

On more personal grounds, the district was chosen because it was small, nearby, and staffed with administrators and teachers known to the investigator. These factors were conditioned by the project's brief time schedule in which data collection, analysis, and write up were to be accomplished in a single semester by a single investigator working half-time. It was felt that prior professional acquaintance and trust would facilitate the work. This methodological hypothesis seems amply supported. In innumerable ways, the observer's path was broken, smoothed and facilitated. "Old home week" was a recurring experience.

Other aspects appeared. The pleasure in seeing, visiting and exchanging reminiscences and ideas with former students and colleagues was "a real plus." It met some long-felt needs of the investigator, who has lamented the lack of an effective mechanism for keeping in touch with M.A. and Ph.D. students who have stayed in the local community. We have no organizational mechanism as effective for us as AERA is on the national level.

In addition, several of the Alte staff had been trained earlier by the investigator in participant observer techniques. They knew the methodology as skilled practitioners "from the inside out." They flooded the investigator with their perceptions, documents, and entry to situations fraught with theoretical provocativeness. In some unusual and extra way, the report belongs to them more than is usual, in my experience, to the participants in prior research.

The two-edged sword phenomenon

Early on, in the choosing of Alte as a possible site, one of the chief concerns was the brevity of the allotted time. One way around that was to go where one knows and is known and trusted. Entry times are speeded. Access to valid data is easier. A backdrop of knowledge, facts and interpretations is implicitly available for developing hypotheses and foreshadowed problems and for comparing and contrasting new data as it comes in. This issue came up in preliminary discussions of research tactics and strategy with the superintendent who had had, some years before, considerable experience in field research (although not with the present investigator). The note on that conversation contained the following point and aside:

> Also discussed some of the negative aspects of being too close to the people in the district and taking liberties as research one wouldn't ordinarily do. (Obs - a good point.)

The "two-edged sword" seemed an appropriate label and it became an item in discussions with most of the "old friends" we encountered in the district. Being conscious of it, bringing it out into open discussion, urging people to speak out if and when they felt they were being compromised, became part of the continuing dialogue.

To the best of my knowledge, the only major violation, if it really be that, was taking large chunks of time for extended interviews. One of these, which was partly "catching up on old times and acquaintances," ran three hours; others averaged better than an hour. In partial defense, it may be more the methodology than the prior acquaintance because several other interviews ran between one and a half to two and a half hours with staff I had not known previously.

A further aspect of the "two-edged sword phenomenon" in the analysis and write up is a tendency to "overcode" for anonymity. He's become she's, her's become his's, and so on. Incidents lose specificity in time and place. Interesting dyadic and triadic interactions become group discussions. In a sense the narrative loses some of its particularistic punch and the account loses the possibility of internal self consistency in validation, extended case analysis or situational analysis as Van Velsen (1967) calls it. Contrasts can be seen with our earlier reports in Complexities and Anatomy.

Sampling

The logic of sampling in participant observation has not been worked out well. Malinowski's early advice on "being around for the events of everyday life" is an early principle. More recently, Glaser and Strauss speak of theoretical sampling. Our work (e.g., Smith and Pohland 1976) has been evolving, in part toward a position which might be called descriptive sampling. By this we mean that at a common sense or layman's level of analysis, the domain can be broken up into sub-domains and each of these can be covered. Early on, we built a chart of the territory and a way of cycling through. This is Figure A-2.

Insert Figure A-2 about here

This plan vied with and eventually lost in part to an earlier plan. Before agreeing to do the study the observer checked informally with several staff members he had known and worked with before. "Will it fly in your domain?" was the question. Each saw no major problems. In the back of the investigator's mind was an earlier sampling notion--"At a minimum, if I can work in detail in at least one of the elementary schools and either the junior or senior high school, I can piece together a narrative and analysis." As time problems mounted, the observer found himself retreating to two of

Sampling Domains

1. Principals
2. Schools and teachers
3. Classes and teachers by weeks

	Cycle 1	Cycle 2	Cycle 3	Cycle 4
High School	Sci	Soc Sci	Math	Alternative High School
Junior High	Team 1 7th	Team 2 8th	Team 2 7th	Team 2 8th
Senior High	School A	School B	School C	School D

4. Elementary Curriculum Committee
   Science, Math, Social Studies
5. High School Committees Preparing for Northcentral Evaluation
   Policy, Math, Science, Social Studies
6. Special Circumstances
   1. Citizens, school board members
   2. Knowledgeable professionals who have contacts in the district
   3. Faculty meetings, P.T.A. meetings, etc.
   4. Special events, programs, activities

Figure A-2. An early sampling plan

the elementary schools, one of the junior high schools, and parts of the senior high school. In that sense the focal data came from several schools; the other buildings and parts of the system were sampled more briefly--mostly to check out ideas developed in the more intensively studied schools.

This kind of sampling was soon coordinated with the time and effort of the site co-ordinator and the site visitors who spent considerable time in the district and tended to concentrate in a particular school or two and a cross section of programs. That too evolved out of some dissatisfaction with site visits elsewhere in CSSE and the personal/professional needs and possibilities of project personnel. Such visits greatly increased "the coverage" and also the range of comparison districts available for contrast. CIRCE's contacts are national and international; so too were the site visitors.

Perhaps the most critical part of sampling in obtaining a valid picture of the phenomenon under study is who determines what situations are observed.[1] In the discussions of informed consent with the staff,the question came up regarding the frequency and timing of observations. In general, the point was made that no teacher would probably be observed more than a few times because of the size of the district and "the K-12, science, math, and social science scope" of the project. This seemed evident and reasonable. Another usual question arose as to "when would the observations be made?" The observer argued again the size and scope aspect, and stated his preference to "pop in" unannounced and as convenient. This, too, was received as reasonable. Requests were made to try to come at the beginning of a lesson and stay through its entirety (especially in the more time-bounded junior and senior high schools). This too seemed reasonable and was honored. The point to be made here was that these arrangements permitted the observer to guide his selections randomly, comprehensively (in one school all teachers were observed), or hypothetically (in pursuit of a particular issue). It precluded teachers or administrators guiding the investigator into those classes, committees, or activities which they thought appropriate for whatever purposes. In fact, only one meeting was closed to the observer; the bigger problem was too little time to be everywhere. In turn, this led to more reliance on interviews--multiple perceptions of individuals who had been in various "everywheres."

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[1] Some aspects of these points arose in a fruitful discussion with Eleanor Farrar of the Huron Institute. We were comparing her reservations about her observations and my more "ultimate" faith in mine; and our varied reliance on interviews of several kinds.

When it's not possible to come and go as the research evolves, the data suffer and, in turn, so do the description and the theoretical interpretation.

Unanticipated time demands

Our experience has been that in spite of careful planning the activity of research always springs surprises, both methodologically and conceptually. Making adjustments, then, toward a synthesis of thought and action is part of the creativity and joy (and frustration) in the research. One of the biggest surprises was three kinds of unexpected time demands:

1. securing written statements of informed consent
2. coming to understand the point of view of large numbers of teachers
3. having a supervisory/site review team involved.

The research had been planned for a tight time line, one semester--in, out, analysis and write up. The time constraints, the unexpected time demands, became a rack inflicting considerable stress.

Much of the observer's recent work has been in the context of larger curriculum development and implementation efforts of CEMREL, Inc., one of the Regional Laboratories. The concerns of informed consent lay with the larger organizational and interorganizational commitments, agreements and "memoranda of understandings."[2] In the CSSE study, the investigator went through several layers and domains of the organization:

1. the superintendent
2. the principals
3. the department chairmen of the high school
4. each department in the high school separately
5. the junior high school
6. each elementary school separately
7. scattered individuals in the schools and community.

In effect, some 10-12 group meetings were scheduled, trips were made to have the forms available beforehand, and presentations of the project were made and discussions entertained. Some were as brief as ten minutes (when the principal had introduced it at an earlier faculty meeting) and some as long as an hour, when the social studies teachers probed critically. Most of January was gone before this was accomplished. It did generate some early overview observations and interpretations that had considerable value. Further, it did solve well the "Who are you?" and "Why are you here?" kinds of problems. Finally, it accomplished its intended purpose, informed consent.[3]

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[2] In retrospect, I think to some degree I neglected or minimized individual responsibility in these instances.

The "Vignettes of Teachers and Teaching" illustrate the second time demand. Initially the observer felt that he could "do" three or four observations per day. In a sense he was extrapolating from earlier studies, e.g., Complexities and Anatomy. What happened in effect, was that the observer was confronted with:

1. a new "three-dimensional" person each time;
2. a particular lesson, piece of content, embedded in a larger, often sophisticated, context;
3. some of that context on occasion was text authored by a teacher, or a notebook indicating his/her conceptions of knowledge in science;
4. some idiosyncratic approaches to teaching which were creative to the point of "blowing one's mind";
5. a particular group of youngsters with unusual talent and intent; and
6. a dozen different schools.

Trying to understand each teacher, administrator, staff member, see him/her from his/her own perspective and in the context of department and school was overwhelming. Somehow each should be in a lengthy, intensive inside/outside relation as was Geoffrey in the Washington School. Somehow the internal dynamics of each school needed the time and attention we gave to Kensington. After each observation and interview, the experience needed to be savored, reflected upon, explored, and recorded. Time. There was never enough time.

Lastly, there were the time demands of a supervisor/co-ordinator and his legions of site visitors. It's been a long time since the observer had had someone "looking over his shoulder." The co-ordinator was an old friend. One of the reasons for agreeing to join the project was the opportunity to work with the project director and personnel. We talked and talked and talked. Sessions ran until as late as one in the morning. The content ranged from his books to my books, his research styles to mine, his conceptual structures and processes to mine. The topics included concepts and definitions of explanation, latent models and metatheories in in educational research, cognitive structures and processes versus more general personality theories and processes, physical science and social science. We observed together and we interviewed together. And we talked. We observed separately and we interviewed separately. And we talked. It's been a long time since I've had such an excellent tutor and have learned so much.

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[3] Issues remain in professional obligations and organizational obligations and implicit coercion when a superintendent or school board grants approval. A teacher who declines must have serious objections.

It wore us (me) out. It took time from teachers, pupils, classes, and schools.

What we needed from NSF was a year's time for reflection, argument and synthesis.[4]

The site visitors must remain anonymous. Each contributed significantly to the data on Alte. One vignette illustrates well the time demand. Late in the semester the co-ordinator wanted to bring in one last visitor--a retired headmistress from U.K. "The fatigue, the press of a few final visits and interviews, an itch to get on with the analysis and I have to put up with another visitor, and a little old lady principal to boot," were the thoughts going through the observer's mind. Then he met her. The four-hour dinner discussion was an exquisite treat. She was as perceptive an observer as I'd ever run into. In the conversation she would comment, "I talked with this boy, and he said something curious... later I noticed the teacher did/said...," and then she would reach for an inference--often one I'd been struggling toward for weeks. Shortly, she made an allusion to "Miranda," and as we blinked and tried not to look dull, she launched into a few minutes on the Tempest and Shakespeare's treatment of the character whose personality was generally similar to but subtly different from the case we had been presenting. This then led to recollections of several interviewees who had been a part of her earlier research project. Their problems and outlook, so she related, were only partially caught in the statistical analysis, cross-tabs and measurement data they had in the study. And all of this was cloaked in a language so precise, so colorful, so full of images. Later, when I did the homework I should have done before, I found our library had three books of hers. There may be more. She writes as beautifully as she speaks. The interview quotes are selected perceptively, juxtaposed with the artistry of a fencing master making the fourth and fifth touches without an intervening parry. The literary allusions and the telling inference appeared on the first page and continued throughout.

Each visitor took time we did not have, yet we did not have time enough with them. Exciting and stimulating, but doubly frustrating.

In another perspective, these unexpected time demands constitute one of the most important side effects of participant observational research--the intimate contact with fascinating people engaged in fashioning their own existence, sometimes with skill and grace and sometimes with troubling struggles.

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[4] A related frustration was minimal time and opportunity to interact with the other site observers. A six or ten week retreat in the summer of '78, with reports, file of data, theories and recommendations would be helpful.

The mix of observations, interviews, and documents

Since we began doing field work some years ago, we have been committed to triangulation or multi-method/multi-concept/multi-situational approaches to data collection (Smith and Pohland 1974, 1976). Illustratively, we have found it more productive to observe an event (e.g., teaching and learning in a history class or the give and take of faculty meetings) and then to talk with participants. At a minimum it gives us a common concrete referent to ground our elusive abstract educational language. In addition, it helps keep everyone honest about realities and ideals.

One of the best illustrations of the triangulation occurred this way. The investigator had observed and taken part in an assembly at one of the schools. As several of us were on the way out, one of the teachers, visibly upset, was "reading out" a group of kids presumably for their noisy inattentive behavior. It was not possible to follow up on it at the moment. Later, in a more general discussion with several other teachers, I recalled the incident, asked what had happened and heard an extended account of the interrelation of other assemblies and this one ("the worst all year"), concerns for the teachers who had planned and developed it, actions by administrators and staff regarding an upcoming program which was full of humor and zest and which in their eyes had the potential for "getting out of hand." A variety of substantive issues in staff morale, organizational processes, school goals were present in the illustration. The main methodological point to be made is that the observation of the particular situation came back a month later as the stem of a question in a discussion and pulled a variety of quite concrete and meaningful items regarding the school.

Similarly, in talking to one of the administrative staff, a reference was made to the public opinion survey conducted in the district. As he commented about different aspects of the program the observer was able to interpret his remarks in terms of the specifics of the report. At other points specific information was available from the Alte School News, which provided an agenda and context for remarks by staff on district-wide events. The array of documents available and consulted are included in Figure A-3.

Insert Figure A-3 about here

In a sense the interplay of observation, interview, and documentation in studying science teaching can be represented in a flow chart of people over time. Typically, the observer would receive a few minutes of orientation--location in sequence, text, today's lesson--just as class was beginning. Then he would observe for an hour. If there was laboratory work or in-class homework or assignments, the teacher would often float by for a few minutes for a bit more explanation as s/he was making the rounds of the pupils and helping them. At the close of the hour we would often

1.	Texts, lab manuals, teaching materials	
2.	Alte Professional Evaluation	1976
3.	Alte Enrollment Forecast	1976
4.	Alte Staff Handbook (Continuously Revised)	1977
5.	Alte Curriculum Guides	1958 - 1977
	math science social studies	
6.	Alte School News	1962-
7.	Local newspapers	
	Morning News	1977
	Evening News	1977
8.	Outdoor Education Documents (state and local)	1976-77
9.	Surveys and Reports by Outside Consultants	1975-77
	IPI Community Survey of Citizens	
10.	Reprints of articles, news notes, etc. that friends thought I might be interested in	1976-77

Figure A-3. Major Documents Consulted

talk for a few minutes more. In some instances if the teacher had a free period we spent twenty minutes to an hour. In other instances this was the first of a number of brief contacts over the semester, and on occasion, lengthy interviews/discussions about science education and related items. Into these came a variety of documents as well. The implicit view of social reality and the relevant methods for approaching that reality seem very important.

Insert Figure A-4 about here

Exit Interviews

One of the variations in procedures for us this time was engaging in a series of "exit" interviews. These were lengthy interview/discussions--usually about an hour, although one lasted two hours and fifteen minutes. They occurred mostly in schools where we had spent a large amount of time. They involved initially a general overview by the individual member--usually from his/her position and perspective as teacher, principal, counselor, superintendent, board member, parent, or citizen. Secondly, the discussion would move toward specific points, relevant to the interviewee's position on which the interviewer sought further clarity. Finally, in several instances, concepts, hypotheses, and interpretations of the observer would be tried out, debated, and explored. That is, attempts would be made to see if the phenomenon existed, e.g., "staleness," and whether alternative conceptualization were possible, e.g., "long term lack of creativity." Further, antecedents, consequences, and interventions would be explored.

In many instances, these interviews turned out to be mutually exciting, stimulating, and lengthy. On occasion overtures were made to terminate them, e.g., "I've taken enough of your time," but an idea hadn't been explored fully and the interviewee would finish a ten-minute point and then find him/herself stimulated by another related issue which had to be clarified if the earlier point was to be clearly understood. The observer was impressed again and again by the interviewees' ability to carry long involved threads of thoughts through multiple illustrations, minor side issues and back to the central point. Provocative but exhausting. Currently we are trying to integrate this kind of interview with other aspects of participant observation.

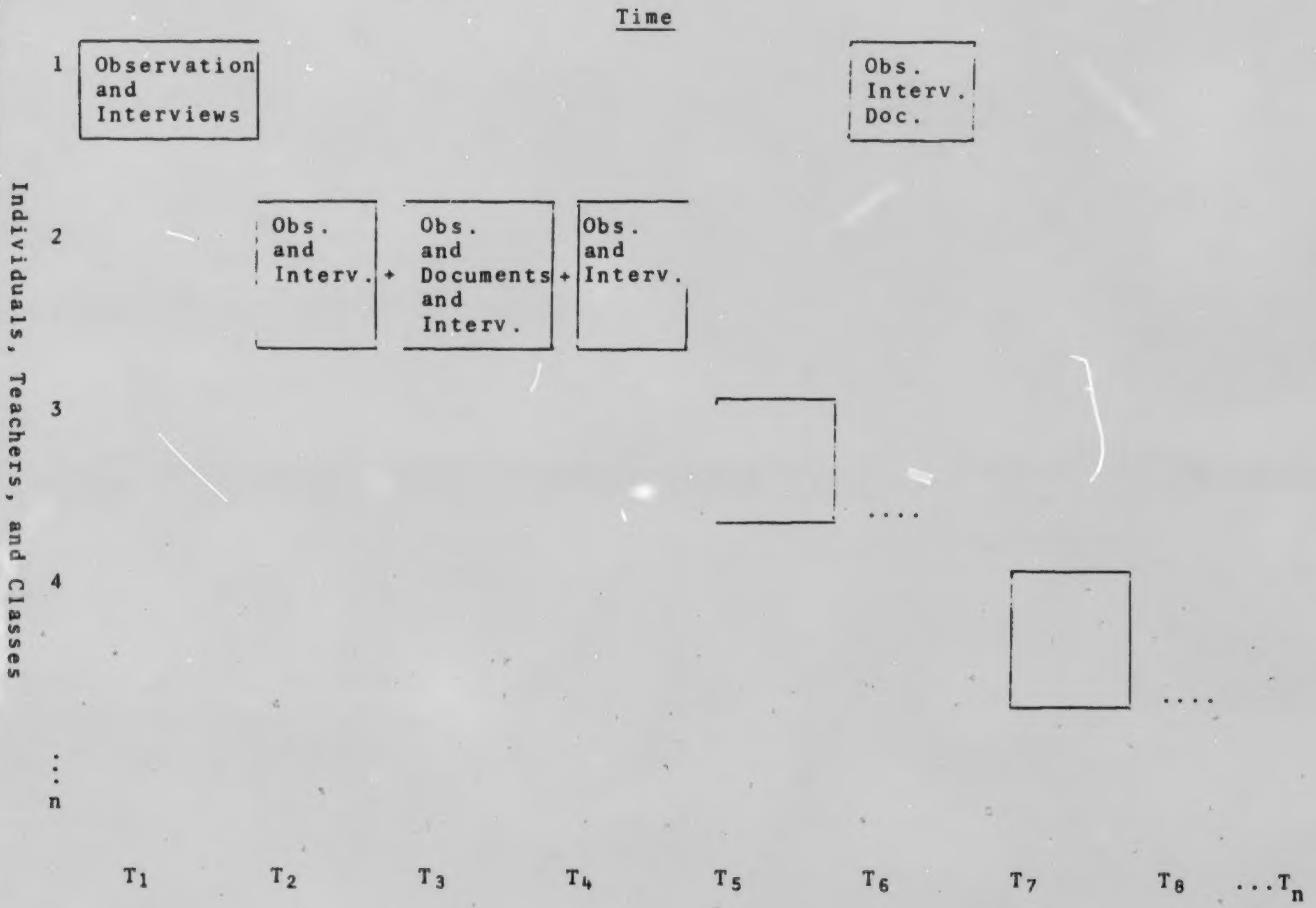
Time
Individuals, Teachers, and Classes
1
Observation and Interviews
Obs. Interv. Doc.
2
Obs. and Interv.
+
Obs. and Documents and Interv.
+
Obs. and Interv.
3
....
4
....
...
n
T1
T2
T3
T4
T5
T6
T7
T8
...Tn

Figure A-4. Interplay of Observations, Interviews, and Documents Across Teachers and Occasions.

Generating Analytical/Theoretical Conceptions[5]

One of the most frequently posed questions in ethnographic research is "the formula" for generating analytical/theoretical conceptions or interpretations. In thinking through aspects of the development of CSSE, that is, while we were suffering through the process per se, a number of items arose, some of which we have highlighted before.

1. Foreshadowed problems: Always we seem to have an agenda of questions from students, from personal concerns about teaching/learning, from reading, from our earlier work. A number of these are listed as part of Appendix 2.

2. Immersion in concrete perceptual images: This is really a question of how much raw data does one have. The day in and day out involvement in the setting produces an ocean of images of the phenomenon, a wealth of particulars--people, situations, events, occasions, etc. The human condition in all of its varied, idiosyncratic, unusual, mundane, exotic aspects plays itself out before one's eyes.

3. The interpretive aside: Along the way, a variety of ideas, insights, interesting associations of ideas, events, people arise. We tend to jot these down into the notes (Obs - ...). Later they become key points in developing the analysis. They seem to "pop out" in the normal give and take of observing and talking with people in the setting. Often they have a free associational quality..."reminds me of..." and sometimes they are simple perceptual comparisons or contrasts.

4. Conscious searching: Concomitantly with the almost unconsciously determined items of the interpretive asides (item #3), there is the omnipresent question, "What does it all mean?" This is a search for overall patterns, for broad themes which seem to break the phenomenon into large chunks or domains. This is an active searching for order. Sometimes, as with the historical emphasis in the CSSE case study, it came early (from reading Toulmin in general and Westbury in particular). It seemed to "keep working for me" both methodologically, in guiding toward interesting data, and substantively, in turning up interesting problems and perspectives. It finally became a major theme (section #2) of the report. Further, it left me with a bit of unresolved tension in

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[5] This discussion benefited greatly from the comments of my Spring '77 seminar.

the form of "Next time, or soon at least, I want to do a for real historical study." With a bit of luck that may be in the offing. That brings one back full circle to a foreshadowed problem (in this instance, a mix of problem and procedure) and means that that study is already cracked open enough to have a beginning point of attack.

5. Similarities and differences: The essence of concept formulation, and somehow I'd never quite seen it back in the days when I was administering the Wechsler and WISC is, "How are they alike and how are they different?" As items appear in the perceptual images, as verbal comments are recorded, as situations appear, as events come and go, one asks a simple two-sided question--How are they alike and how are they different? The similar things are grouped and given a label that highlights their similarity. The different things are grouped, insofar as possible, and given labels. There always seems a large "miscellaneous" category of items which seem important but which don't fit anywhere. The "seem" is critical. There's always a hunch lurking behind the "seem" and given more data, more time, and more thought, the pieces find a place in relation to one another. Earlier we called this the "jigsaw puzzle analogy."

6. Concurrent outside activities: During any project a number of things seem to be happening concurrently in one's life. Single strand existences don't exist. During CSSE I was

1. at a conference in Germany which pushed me to read Decker Walker's book--and Westbury's chapter and also involved me with a variety of people and points of view. Some were new, some were old, both as individuals and from their scholarly work.[6]

2. already reading Toulmin and Goodfield who had been suggested to me years ago as an overview to the history of science.

3. chance reading - a graduate student had been talking about Sheehy's Passages.

4. in a GIE committee, evaluating assistant and associate professors and all the problems of "effective professing" of which "effective teaching" was one major element.

5. at AERA- symposium and conversations with old friends.

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[6] A conference report, Theory and Practice in Educational Research, was published by the Institute für Didaktik, University of Bielefeld in 1976.

6. in seminar at GIE, everyone doing a p.o. project or case study. Mine was CSSE. Free for all in these.

7. Project press: As mentioned elsewhere, the short time line on CSSE produced enormous pressure to move quickly, to begin intensive attempts at conceptualizing early to seek workable outlines. This produced a series of stresses, some of which were toward conceptualization and interpretation.

8. Formal Analysis and Writing: Finally, in the end of May, and all through June, reading field notes, the summary observations and interpretations, and the multiplicity of documents produced the intensive search for order and the final patterns presented in the writing.

Implicit in other parts of the report and the appendix, one can find other remarks which round out the biography of the project.

Conclusion

In conclusion, these snippets must stand in for a more developed essay. But vignettes have their own kind of potency and perhaps they will suffice. The interested reader might consult several earlier sources. In Complexities we wrote a long introductory chapter and appendix on methodology and procedures. Concepts and issues such as foreshadowed problems, basic guiding, constructs, interpretive asides, two realities problem, and model building are all revised. In Anatomy we scattered the methodological issue throughout--as the index indicates. Paul Pohland and I tried to come to grips with Glaser and Strauss in a paper published in 1976 but written a decade earlier and in the appendix to the Rural Highlands Study (1974). Finally a scattered series of papers and symposium addresses (Smith 1967, 1974, 1977) clarifies further our methodological position.

Finally, we have wrestled with and been guided by a number of field workers: Homans (1950, 1962, 1967), Malinowski (1922), Becker (1952, 1961), Bruyn (1967), Glaser and Strauss (1967), Denzin (1970), McCall and Simmons (1969), Whyte (1955), Iannaccone (1962), and Van Velsen (1967). All of them kept speaking to, answering, questions that we kept running into. Perhaps the most amazing experience has been re-reading some of the early favorites, i.e., Homans and Whyte, and finding how much they had learned and had to teach the second and third time through, several years later.

APPENDIX II

CSSE - A Small Suburban District: Preliminary Plans[7]

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January 1, 1977

1. Introduction

It has been my experience that a brief introductory overview of problems and procedures of an observational research project has been helpful as an initial point of departure for the observations, a reminder of the original focus (the forest) when the trees of data are everywhere, and as a gyroscope for the later analysis when intriguing side issues loom large.

2. Foreshadowed Problems

The original purpose by NSF and CIRCE investigators lists an array of problems to which we'll attend. At a more personal level, several additional items appear which I'm eager to have the data speak to.

2.1 A number of issues in the nature of science, its history, methods, formats of results, goals, and so forth. Briefly, the list includes positions taken in the following books:

Toulmin and Goodfield - Fabric, Architecture, Discovery
Hempel - Aspects of Scientific Explanation
Scriven - Primary Philosophy
Maslow - Psychology of Science
Ziman - Public Knowledge
Homans - Nature of Social Science Theory
Diesing - Patterns of Discovery in Social Science

In effect how do the relevant groups (citizens, board, administrators, teachers, and pupils) conceive of and operationalize into programs the various possible conceptions of science?

2.2 A number of issues in science education, teaching, curriculum, learning, and development. Typified by articles and books by:

J. Schwab
D. Walker
E. Anderson
M. Otte
L. Shulman
P. Hirst

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[7] This project is supported by NSF. The project is a subpart of CSSE, principal investigators are Professors Robert Stake and Jack Easley.

2.3 A number if issues in school organization and governance
   a. citizen and school board influences
   b. teacher committees, reference groups
   c. articulation between elementary, junior, senior high programs
   d. alternative schools

A variety of people come to mind here:
Smith and Keith
Lortie
Charters
March and Simon
Bernstein.

3. Procedures

3.1 "Standard" participant observation technique will be used.

3.2 The major unit of analysis is the school district's science program. The accent is on both the "district" and "science program." In turn, these break into level of school, subject areas, teachers, pupils.

3.3 My initial hunch is to focus concurrently on the high school, the junior high, and one elementary school. Perhaps this will be done best by "waves," that is, a week's cycle at each level and back again.

3.4 Many of the educators in the district are colleagues, former students, and close personal friends. My hope is that this will make for ease and flexibility of entry observation and interviewing. The greatest difficulty will probably lie in making the final report honest and critical where necessary - if it implies negative judgments on friends.

3.5 Historical contextual aspects and unobtrusive measures from school yearbooks, North central evaluations and other documents, library usage, counselor comments and records, follow up studies and so forth, will be noted.

3.6 Because of the interrelationships with other elements of CSSE, my hope is to implement the "memo's" strategy we used in the AEP X Pilot Study. Essentially these were vignettes, tentative interpretations, and questions and asides that were occurring along the way. This had aspects of formative evaluation and presaging of the final report. At a minimum, these should appear once a month, that is four or five times during the semester; they may be considerably more frequent. An added aspect of this kind of reporting lies in the brevity of the project; the final report is due almost immediately at the close of the semester, rather than six to twelve months later.

4. Results

4.1 Our usual procedure has been to accent description and analysis, that is, an overview in lay language of the phenomenon (science education in a small suburban district) and a theoretical interpretative analysis. That still seems reasonable although it may be interpreted or focused in terms of NSF's overriding concerns on its current status of science curriculum and science teachers' activities they have supported in the past.

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Professor Louis Smith of Washington University's Graduate Institute of Education contributes to this project his expertise as an ethnographer and as a case study specialist. Recipient of a Ph.D. from the University of Minnesota, he worked with both the University of Minnesota Psycho-Educational Clinic and the St. Paul, Minnesota, Public Schools (as a school psychologist) before joining the faculty of Washington University in 1955. He and his family currently reside in Kirkwood, Missouri.

Lou's participation in professional activities is extensive. In addition to providing consultant services to schools, publishers and the USOE, he has taken part in numerous conferences and workshops and several USOE-funded research projects. He has served, at various times, as project director, senior research associate, and evaluation specialist for CEMREL, Inc. (1966-76), and in 1974 received a Fulbright-Hayes Senior Research Fellowship for study at Massey University, Palmerston North, New Zealand. His long list of publications reflect the range of his interests. Among the highlights are several books: Educational Psychology (with B. B. Hudgins), The Complexities of an Urban Classroom (with W. Geoffrey), and Anatomy of Educational Innovation (with P. Keith).

Chapter 4

SCHOOLING AT BRT: A RURAL CASE STUDY

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October 1976

4

Science is spotlighted in the presence of an outstanding female instructor, the latest in a series of "Mr. Sciences" in this rural midwestern site, and in the surrounding farm lands where principles of scientific management of land, machinery, fuel, and fertilizer dictate events.

Family farms are growing larger; school enrollments are declining as rural market-towns lose their basic purpose and historic functions amidst an urbanized society. The area is prosperous, the schools do not lack for material resources. Nonetheless, another round of consolidation seems near, the observer reports, because of inexorable pressures exerted by demographic shifts and economic forces generated by national and international affairs.

Morale and pride may not be enough, the study suggests, if ingredients essential to a comprehensive curriculum and maintenance of reasonable class size are not at hand. A former board member remarks:

> *I have a neighbor who still thanks me for the advanced math class of only three students he took. This was twelve or so years ago. . . . On the board we discussed that small class quite a bit. In the end, we justified it by the results of the education of the youngsters involved. . . . Now, people often vote their pocketbooks and not their intelligence.*

The sons and daughters of land-holders know where they are going--i.e., back to the farm--and are impatient to get there even if four years of higher education loom immediately ahead. Meanwhile, their classmates leave for nearby cities *and, perhaps, a place in the junior colleges where vocational classes abound.*

Current debates over environmental issues suggest that BRT may represent the climax of an agricultural era dominating the United States in the past quarter-century. It has served the nation and its people well, and has produced bountiful harvests for other countries, too. But the accompanying changes in land use patterns have irrevocably altered the face of rural America. BRT stands out as a classic example of this interplay of technology, land, and recent advances in agricultural research.

Maybe, just maybe, seeds of doubt concerning whether a continuation of this course is the most desirable option for BRT, Illinois, the midwest, and the nation are discernible in the following pages. Some readers, however, will see them as an eloquent testimonial to a revered way of life.

SCHOOLING AT BRT: A RURAL CASE STUDY

Alan Peshkin

BACKGROUND

Spirit runs high in BRT, the school district always referred to by the first initials of the three towns that compose this midwestern, rural, consolidated school district. B is for Barton, R for Rhodes, and T for Turnview. The visitor to BRT High School during its most spirited week--Homecoming--would have seen signs attached to walls, ceilings, and lockers urging BRT's Panthers to "Beat Dawson to a pulp" or "Bash their skulls in." The seventh period's family living class took comfort that "The Dawson Bulldogs are sterile. They can't produce a victory." And, indeed, they couldn't. For BRT won this game, as well as the conference championship for the second consecutive year. On the strength of such successes (and others announced in newspaper clippings featured in the display case of the building's main lobby: "Area Youth's Science Paper Second Best" and "BRT Takes Area's Top Science Project Award"), good feeling prevails in BRT, but possibly not for too long; for in the midst of this year's football season, the superintendent surveyed the approximately 1600 residents living in their eighty-three-square-mile school district. This survey confirmed in the most unavoidably drastic terms what had long been sensed and feared by BRT loyalists: the number of children born in the school district during the past five years had declined precipitously and probably irreversibly. The results showed sixteen children under one year old, eighteen under two, fifteen under three, sixteen under four, and fifteen under five. Moreover, there are only seventeen students in the fourth grade and seventeen in the fifth grade, although the overall total in K-8 of 212 establishes an average enrollment of about twenty-three per grade. A four year high school of under 70 students, in contrast to its present 136, seems not far off, though it is unlikely ever to be reached. Most probably neither the state nor the school district will allow it to happen. From all indications, the forces of consolidation are once more gathering momentum in rural Illinois, and the BRT that emerged in 1953 during its last crest is most likely to be replaced by some new alphabet soup.[1]

In the meantime, contentment prevails in BRT. "Silence," says one school board member, "means things are OK at school. I'm available in my store so I easily hear complaints. A while back we started hearing about music because we only had one teacher. We hired a second one and now that's OK." Parents and teachers are too modest and too honest to claim they've attained educational nirvana. Yet the dominant tone is of general well-being, order, control, and a reasonable degree of success, whatever the domain. The result is a strong feeling of pride. Some teachers are seen as stronger than others, and some wish they could perform more competently than they do, but there is no visible distress directed toward any part of the school program. The band is good and so are the athletic teams. The non-college bound get jobs and the college-bound gain admission to college and do as well as students, teachers, and parents expect. Teachers appear to be in accord with each other and student-teacher relations are amicable. All groups are pulling in the same direction, guided by a shared though not necessarily explicit sense of end and appropriate means.

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[1] About four months after the above mentioned survey, BRT residents were polled to learn their feelings toward consolidation. Of 606 responses, 170 were definitely against it, 329 thought the school district should be looking for other districts favorable to consolidation in BRT, and 103 were undecided. Upon receiving the results of the poll, the school board voted not to pursue the matter further.

To be sure, last year's tax increase of forty cents in the educational fund and twelve and a half cents in the building fund was useful, but it proved to be a stop-gap measure, at best, that could not keep the budget in the black or deter BRT's Citizen Advisory Committee from exploring school programs for possible elimination. Notwithstanding the potential for financial hard times, BRT's prevailing sense of well-being reflects the years of affluence enjoyed by its farmers whose astonishingly fertile black soil economically undergirds the school system. And it is their ethos which dominates, because school board members past and present have been drawn from the ranks of farmers. Even the teachers reflect a rural orientation, with fourteen of thirty-three living in the school district and another nine commuting from nearby small towns. In accord, however, with the agricultural realities of the nation, no more than five per cent of BRT's present high school students expressed a desire to farm.

Grades 5-8, BRT's four-year junior high, are located in a venerable building in Turnview, strong on memories but lacking somewhat in modernity. High school students boast that perhaps no other school in the area is as clean as their own, referring to the almost twenty-year old, T-shaped building which houses grades K-4 and 9-12 in Rhodes, the middle town of the three which comprise the district. A most common sight in the halls of the big building is the custodian, pushing his broom with the four-foot-wide sweeper along the never very dirty floors. Any tendency to litter is deterred because of another common sight in the halls--the superintendent. In between class periods, he stands at a crossroads in the high school wing of the building, his presence reinforcing the order to which he is committed. He is a new superintendent, only the district's third since 1953.

In fact, the stability conducive to the establishment of tradition was provided by the district's first superintendent, who administered BRT from 1953 to 1973, enjoying the same five school board members for a full fifteen years of that tenure. And the tradition that prevailed during most of the district's existence is identified as conservative--"We don't buy everything that comes along"--regarding ideas and material goods; respectful of the basics--"We hear about this all the time on the board. We read about it in the journals. Teach 'em to read. There's no kid likely to graduate from BRT who can't read"; and supportive of educational achievement:

> *I have a neighbor who still thanks me for the advanced math class of only three students he took. This was twelve or so years ago. The emphasis then was all who wanted to go to college should have the opportunity, if it was feasible. On the board we discussed that small class quite a bit. In the end, we justified it by the results of the education of the youngsters involved. The education of students was our number one priority on the board at that time. Now, people often vote their pocketbooks and not their intelligence. We had high ideals. Educate kids within our means, facilities, talent, and the capacity of the populace to support. Our philosophy was education.*

By almost any standards BRT is a small school district. It experiences, accordingly, the limitations of such districts, though mitigated by its exceptional tax base.[2] Most reactions to BRT reflect the fact of its size, not its rural location. Other than the vocational agriculture program and an occasional teacher's or student's reference to agriculture to exemplify a point, the curriculum is not influenced by its rural setting. Board members say their school should be no different from an urban school, since the overwhelming majority of graduates live elsewhere and don't farm. "The needs of students should be dominant. We educate them for an unknown future." One educator, though, reflects on the mass exodus of graduates with some regret, noting that it sweeps out of the community persons whom he believes would make valuable residents.

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[2] With an assessed valuation of $20,000,000 and an educational tax rate of 2,000, BRT has more money available per student than most districts in the county.

> *Academically-oriented kids leave . . . . We don't keep those who use education to advance themselves. The ones who stay look for things oriented to the land. Our doctors and lawyers are all off somewhere else.*

But the limitations of size are not critical, and even those who identify them probably would not wish to pay the "price" of a larger system in order to gain its advantages. A parent says,

> *There's too few offerings on the one hand and too little competition on the other. When my son went to the university he was at a disadvantage in his trig class. The big city kids had a background that he didn't have.*

A board member believes their small size restricts the curriculum. The junior high principal notes the same point: "We can't offer the shopwork, typing, and that sort of thing." He adds, however, that they have solid reading and math.

> *If you go through those files [he says, pointing to a filing cabinet], you'll see that our kids test out slightly above average in all subjects on the Stanford Aptitude Tests. Students leave here as well-prepared in the basics as kids from any school anywhere. And we have no discipline problems like in bigger places. Teachers don't have to take time to worry about classroom control.*

And a parent agrees, with one reservation expressed without concern:

> *My daughter got as good an education at BRT as she would get anywhere. Big city kids function better at the university and in business, but this I think results from the social mix in the city and not from educational factors.*

The curricular meaning of smallness, notwithstanding an uncritical perception of its consequences, is perhaps best captured by these facts: the high school has only one social studies teacher, one math teacher, and one science teacher. (The vocational agriculture teacher offers the required course in earth science; but it is agriculture, not science, that claims his major attention and concern.) Accordingly, if the instructor is weak a student's entire educational experience in the subject is impoverished. And the subject's program is only as strong as one teacher can make it. Furthermore, the social studies teacher teaches five periods each day and has four different preparations; the math teacher teaches six periods with six different preparations; and the science teacher teaches six periods with five different preparations.[3] Each teacher has one free period daily.

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[3] By choice, the science and math teachers teach six periods. The standard load is five periods, one study hall, and one preparation period.

Within the above general context of fact and feeling, science, math, and social studies are taught. More specifically, however, we see the three subjects enjoying a differential status in several different respects. First, the school requires only one year of math and social studies, while it requires two years of science. (No conclusive explanation was provided to account for this distinction.) Second, variable salience is attached to each of them, social studies laboring under the lowest esteem, with science and math substantially more respected, possibly in that order.

The following set of quotations from parents, board members, teachers, and the guidance counselor will demonstrate social studies' role as academic stepchild, whose only permanence in BRT's high school curriculum comes by virtue of the state requirement of one year of U.S. history. For example, a teacher points to the students' vocational orientation and consequent dissatisfaction with social studies.

> *I've taught social studies. The kids look on it as not really necessary. Even in U.S. history they ask what good it'll do me in making a living. Kids see social studies as something to get credit for that won't be as hard as math and science. So they're looking for a watered-down program.*

A parent believes the students' greater knowledge of the social world turns them away from the study of it.

> *The knowledgeability of students about world and state affairs affects their response to its study. They know more about social studies than about science. So they feel they don't need social studies. This is to their credit, I think. Besides, the whole atmosphere of the school is toward citizenship, not just the social studies.*

One board member observed that there has never been much talk about the subject at board meetings and he had no idea why it was not more important. An administrator of long experience confirmed this observation.

> *There's just been no reaction from the public to social studies. There has been to English, math, and science. In English, if you don't buckle down to it, you don't get it. Math and science need to be talked about in class. But social studies is less controversial as far as the calibre of teaching demanded by parents. In twenty years I had no criticism and it is not as though the teachers were always doing a good job.*

Finally, the conjunction of coaching and social studies teaching during most of the life of the school district has placed this area of instruction in the hands of the least stable person on a high school staff, the coach. One educator felt that it was not the fact that the coaches were coaches that made them poor social studies teachers, but, rather, what they were like as teachers. Another disagreed.

> *Over the years we've had as many games replayed in class as history lessons taught. The tendency is for the teacher-coach to digress in class. And there's not much history taught on the football field. We've been the victim of the college tie-in between a coaching major and a social studies minor.*

Math, in contrast to social studies, is perceived as related to vocational needs. It benefits from the general sentiment of being a basic subject and is therefore taught, indeed emphasized, at every grade up through the ninth. After that, students often perceive it as too difficult, as do their parents. And though approximately two-fifths of the students take a second year of math, many take the vocationally-oriented technical math course. Table 1 below indicates the comparative attractiveness of optional study in math, social studies, and science. Math occupies a middle position in attracting students to its opportunities, about one-third of the students enrolling in technical math. "In my opinion," says a board member, "math is more important than a foreign language." He continues:

> *I've got to go with my experience. I never took a foreign language. I doubt that my daughter in high school will need a foreign language in later life. Math is tops, I guess, because it's important in my business--electrical work and farming. I can't see a person go through life without math. English isn't that important [look at President Ford], especially literature. I think this is the board's point of view. But we did go for that extra teacher in music. It probably helps with leisure time.*

TABLE 1
NUMBER OF STUDENTS TAKING OPTIONAL MATH,
SOCIAL STUDIES, AND SCIENCE COURSES, 1974-76

Year	Math	Social Studies	Science
1974-75	38	22	39
1975-76	33	29	56

The reservations about taking much more than the required year of math, however, are set forth by the high school guidance counselor, who has mediated between students and their course selections for many years.

> *People are turned off by math because they think it's harder than other subjects. They can say about a course like biology, "OK, I'll get this and I'll relate it to being on a farm." But if they get to advanced math without a goal for using it, they can't relate to it. Local parents are defensive about math, while they know their kids got through earth science and biology OK.*

Among all academic subjects taught in BRT high school, science occupies a special place. Notwithstanding that BRT requires two years of science study (one in earth science and one selected by the student from courses in biology, botany, zoology, chemistry and physics), the area does not predictably draw significantly more students to its classes every year than does math. But it seems to possess an aura of favor, acceptance, and responsiveness to it greater than that of other subjects.

The two-year requirement is variously explained. One explanation holds that it is BRT's reaction to the North Central Association's strong recommendation to this effect at a time when the district had been on a warned basis. Another explanation is that, since the University of Illinois requires two years of science for entering students, it is wise for BRT to do the same. Meeting these requirements thereby qualifies BRT students for any university they would want to enter. This argument does not hold up, though, since the University of Illinois also requires two years of math. "In the end," explains one educator, "the community prefers science and that's how we justify two years of science and not math."

Science has benefited from having been taught by the same teacher, Mr. Burg, from 1953 to 1972. By grading generously he made it easy for students to take science classes. For example, in a two-year period which is indicative of their usual pattern of grading, Mr. Burg awarded forty-three of fifty-five and forty-eight of sixty students either A's or B's; while Mr. L., the math teacher, awarded only twenty-one of fifty-three and twenty-three of sixty students either A's or B's. The school board appreciated Burg's contribution.

> *When you have a good teacher you try to make use of him if what he does fits in with your program and the needs of the kids. Mr. Burg was liked by the community and by the students. He cared even after they got out of college. Our daughter made a point to see him whenever she came home. He set up our science fairs.*

These science fairs are the closest academic counterpart of the invariably popular musical or athletic performance. They have been and continue to be important in shaping a climate of support for science study. Student projects are prepared, displayed in the gym, and compete with other student projects, locally, regionally, and eventually on a statewide level. The fairs attract many parents, including those without students in the competition. Being contests as well as displays, the fairs provide a clear sense of winners and losers. "What the people can see and they know they like, you get pressure to emphasize," said one board member. A former BRT administrator acknowledged with regret the competitive aspect. "Parents (look) at the prize end of the fair more than what the kids (get) out of it." But he went on to emphasize the student gain.

> *The fairs give kids incentive to delve deeply. I know my daughter studied DNA. She wrote quite a paper; learned many things I didn't know. The projects were mostly extracurricular, but naturally they also worked on them during class time.*

Mrs. N., the present science teacher, continues the science club and the science fairs begun by Mr. Burg. She exceeds the ordinary expectations of her status and is appreciated for this contribution. Last year, for example, she helped several girls study anatomy on an individual basis during her only free period. Anatomy is not taught at BRT. The board purchased the cats for dissection and Mrs. N. provided the time and instruction. She has the confidence of the board members and gets from them the equipment she needs, though actually she needs little since the larger lab equipment was obtained by her predecessor with the help of NDEA funds.

The next section, which focuses on science at BRT, provides a more extensive picture of Mrs. N. and science education. It contains, as do the subsequent sections on math and social studies, several documents which are intended to portray this study's target programs: interviews with teachers who at the high school and junior high level embody the particular program described in the section; excerpts of notes from high school classrooms' teacher-made tests,[*] and interviews with high school students; and excerpts of notes from grade school classrooms and interviews with grade school teachers. As the product of either handwritten notes or tape recordings, these documents are essentially verbatim statements. They have been edited by omissions, the addition of a transitional phrase or sentence, and in the case of the interviews, the elimination of my questions which served to introduce or change a topic and to seek clarification or elaboration. While editing, of course, bears interpretive connotations, the documentations are nonetheless meant to present a particular reality rather than interpret it. That they are at best a partial representation of reality is evident from the limited sample they constitute for any given teacher and subject matter area.

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[*] I include tests because I believe they are particularly indicative of those things teachers most value, though not exclusively, their students' knowing.

SCIENCE AT BRT

Mrs. N.: High School Science Teacher

"I taught at other schools before coming here, but they were larger places. I saw a student for fifty to fifty-five minutes a day and that's all there was. What they did with their lives otherwise, I didn't know. Here I think there's not the stigma of, 'You're the teacher and I'm the student and I have to keep all my personal things away from you.' Also, the students here are in so many organizations you keep running into them. And I think they're just much more open. I'm generally here till 4:30 or 5:00 everyday, so I see a lot of the kids. If things aren't ready for the next day, I don't like to leave. Maybe I'll bring papers home to grade, but that's all. There is one thing I miss about a larger school though. The one I was at before gave a free period to the department chairman and he'd come watch us teach and offer constructive criticism. That's one thing I miss here tremendously. There's no one in my area who can come and say 'Now this might be a better way to do this.'

"I've got too much to do at home. I enjoy reading and I'm an avid gardener. Both my husband and I kept tropical fish as a hobby before we were married and we still do. I read everything from the scientific to science fiction to women's magazines. We're magazine poor with our Scientific American, Natural History, Chemistry (that's from our membership in the American Chemical Society), Consumer Report, McCalls . . . You name it and we've got it. There's a couple of journals from the Illinois Education Association and the National Education Association, but none from the Illinois Association of Chemistry Teachers or from the Junior Academy. That's the organization that sponsors the annual science fair.

"For a while I spent summers taking courses for a degree in counseling. Then my husband talked me into taking a rest. He was right; I needed a rest. Springs have always been rush, rush, rush for me. But I like teaching science because I like the kids, and I could never be a research scientist, much to my husband's dismay. After college I thought I could have gone either way. I applied for some jobs in industry and was told by two different gentlemen that because I was female they could not hire me, even though I had better grades and recommendations than some males who were hired. I'm not a women's lib person, you know, but that kind of thing bothers me. At this time it is no longer annoying because I enjoy what I'm doing. I might like that lab situation for a week. After that I'd become very frustrated at the lack of interaction with other people.

"At Eastern Illinois University I majored in chemistry and also fulfilled the requirements for my teaching certificate at the same time. So I was prepared to go either way. I think what really decided me not to pursue industry was my practice teaching experience with Mrs. Dawson. She just didn't turn over the class to me and disappear for six weeks. She helped me set up labs, took home half the homework and graded it, and she sat in her little office between the science lab and classroom and listened to me teach. Then she'd give me lots of pointers. And I also had a grandfather who influenced me to teach. He was a science teacher himself and as children we stayed with our grandparents for several weeks each summer. He passed away when I was in college so he didn't have much influence on my four younger brothers, but my older brother and I both went into science. I've always liked science, though, and I was one of those rare people who went into college with a major and stuck to it for four years.

"What keeps me teaching is the kids. I like teenagers. Also, I like the type of people who are teachers. I even liked teaching remedial science. I once had such a class at another school. It was a welcome change for me. When summer ends I always feel a certain amount of exhilaration about school starting.

"I think science is important for kids to study. Many just don't pay any attention to what's going on around them. Of course, not many will have a career in science, but they have to have a feeling for what's going on around them. At least some kind of feeling for it. I hate apathy. Why let anything go by without even a passing glance? I want students to have an interest in those things that are scientific in their daily life. They should develop an appreciation or a feeling for different theories and beliefs--there are some things in science that aren't that specific--and then extend that to having a more free attitude regarding the feelings of those people around them. I think that's important because our students are so isolated. They are a prejudiced group--against blacks, against Jews, against anyone who lives in the city. Whenever we get a new student, they're very slow to accept that student. So, hopefully, if you can get them to accept different ideas in science, say different ways of looking at the structure of the atom, maybe they can learn to accept different viewpoints over in their social life. Another thing. Recently biology students were looking at cells under a microscope. They were supposed to describe what the cell looks like. 'What am I supposed to write?' That's what they want to know. I'll tell them, 'There's not necessarily a correct answer. Describe what you see.' Then if they do a good job, they have a perfect right to feel some kind of pride because the results are from their own thinking. This is something else I want them to get from science.

"Sometimes I'll ask the kids at the beginning of the semester to write out on a piece of paper I pass around what they'd like to study. The only answer I got that was something different than what I'd already planned was one kid said he wanted to learn more about sex. Well, science as such didn't mean anything to me when I was in high school. It's biology or physics, etc. And within those specific areas it's learning this piece of material and then that piece of material. The students who take the upper level classes are so motivated to do well they can go ahead toward whatever their goal might be. Their grade--that's all they think about. Getting through that test and this test. I would hope this isn't true, but that's the feeling I get from them. Sometimes kids will see something on TV that they'll bring back to class with them. There was a movie on snakes that they asked about, something recently on the La Maz method of birth, and at the beginning of the year a show on spiders. They'll come with questions and we can branch out from there. When we talk about these things that don't have anything to do with what we had planned for the day, it makes them think class was fun. I don't see anything wrong with spending ten, fifteen, or twenty minutes talking about such things on a particular day. It's related to science. If there's one thing I emphasize more than anything else, it's enjoyment. Getting some pleasure from learning. It bothers me when I see kids consider learning as a drudgery. I enjoy learning things and I hope the kids can learn this, too.

"There are very smart students in this school, but they don't join our science club. This is very frustrating to me. On the whole, the ones in the science club, well, their ability is not as good as it ought to be. We run kids so thin here. The boys are in football and basketball and they're doing all these other things. Besides which they're very conscientious students and I have to respect their feelings that they don't have time. Many schools combine a student's work in physics and chemistry with science fair projects, but that's against the Junior Academy's rules. I'm probably too lenient but I don't like to put kids under that much pressure from both science class and science club. Students are out for sports, they've got no study halls, so when are they going to get to my room to work on a project?

"We've got some parents who are interested in science. Of course, I see a special group, those whose kids have science fair projects. Otherwise, I have such limited contact with them. Some parents will push their kids up through Chem. I, so I've got fourteen students in that class. Chem. II and Physics are another story. Students are scared away.

Math is a big bugaboo. Was for me, too. There's a minority of people that math doesn't scare 'em. I'm not in that group. I told the kids that my worst grades in college were in math.

"Today there's less interest countrywide in science than there was when I first started teaching. There's less of a push to be a scientist and more to be a technical person because they make more money. Before, I sensed a feeling that to attain the good life people thought, 'I'd have to go to college and to get to college I'd need science.' Now they see Joe Blow who's forty-fifth in a class of forty-six making $9 an hour and digging ditches, whatever. So they say, 'Why should I bother to do this extra work to go to college, to take science.' We're very materialistic, I'm afraid, and getting more so. Right now, it seems, the shift is back to the basics, like learning vocabulary and laws and problem solving more than technique. Lab technique is still important but there's all this worry about kids not doing well on ACT and SAT. I look at the new texts that are coming out. They tend to be more organized, giving the student information and then expecting them to remember it. I'd say we've always been more traditional here than larger schools in the metropolitan area so I don't think parents were that much aware of a change back, but I get it from parents who are also faculty. You know, 'My son or daughter didn't do well when they took the ACT,' that sort of thing. And the students feel they didn't do well because they didn't know what the words on the exam meant. Especially in the science area. More traditional teaching of science would teach these words more effectively. It would leave out, however, some very important things like thinking for yourself and being able to deduce from a group of information some generality.

"I can see the results of the new math on all the students I've had here. As sophomores, they don't know how to do long division. I mean this is not just the academically low kids. At the beginning of the year I show them how to know what their grade is at any point in time. I can see then that most don't know how to figure up percentages. It really shocks me. Now if you ask 'em about the commutative law of addition, they know what that is. They're lost to science as far as math is concerned. But in lab, they do quite well. At least they have in the past few years, ever since the science teacher in junior high has provided a lab experience. They're much better able to look at an experiment, note its purpose, and be aware if something is happening that doesn't make sense.

"It's really helpful to find students coming to class prepared for science by their past experience. Mr. O. and I meet as often as we can. At the end of some teacher workshop days we can get together. We've worked a lot with chemicals and such 'cause a lot of things he doesn't have. So we share back and forth. This is all informal. But a few years ago when the state superintendent required all the schools to prepare objectives, we met frequently. This forced us to look at what we were doing. We tried not to be so repetitious. That's when we decided to offer some semester classes--botany and zoology, and to not require biology, because they get quite a bit of biological background in junior high. I've tried to encourage more of the students to take chemistry because Mr. O. doesn't cover that as heavily. The primary people were also involved, but most of them don't do much with science. Some do more than others. There's a lot more important things the primary grades must do. At least once a year, though, we try to get each primary class down here to the science rooms. I set something up for them to do. One year we had planaria and so we all watched them eat. Last year we had frogs. We had two living frogs that we tried to let the kids feel and touch. I couldn't hold on to them and we had frogs going all over. The kids thought it was great. They come down so they can get a feel of what science is like. Mrs. T., the second grade teacher, says her kids love to come to the science rooms.

"From my own tests I would guess at least half the class has really understood what I've taught. Maybe another quarter are borderline. I'm talking about biology now. It's very discouraging sometimes. When I give a test I have lots of A's and B's, a few C's, and lots of D's and F's. I don't know whether it's me, the subject, or what. Other teachers don't seem to get this distribution. In chemistry and physics the results are different because the group is more select. They're mostly A's and B's.

"For the brightest kids in any of my classes I don't do anything that special. Nearly always on an assignment or a test I try to have something that is not answered right in the book. Then I expect only those upper students to get it. And I bring a lot of materials from home when questions come up, things that they can read. I find that I help the lower ability students best in lab. They've usually chosen each other for partners and this helps because this way they're more apt to ask me questions. It's not embarrassing for either one as it would be if they were with more capable partners. In the lab you're not putting yourself up in front of everybody when you've got a question to ask. So I think the lab is an equalizer. Probably the study guide approach is more directed to the low kids, too, at least those who are motivated enough to look up the answers. I try to make up one for each chapter, picking out what is most important.

"These study guides I think are useful for some students. Others find them boring. Anyway, they are not that important in my plans. Generally on Thursday I try to work out the next week in a general way, what material I hope to cover each day, that sort of thing. But just what I'll do on any given day depends on how things went the day before, whether they understand, what the atmosphere in the school is, you know, when they're really up about something else.

"By the middle of October or so I generally have a fairly decent idea of how much material a class can handle. Now I'm all goofed up in Chem II because I thought they'd get more from this one particular reading than they obviously had. My plan book says they're supposed to begin an experiment. They're not ready. This doesn't bother me, though it would some teachers I know who are intent on getting through the book. My philosophy is a little different. What does bother me is when a particular kid is in trouble. You know, 'Why, why doesn't he get it?' Or, 'Why doesn't he have more self-motivation? What can I do?' Sometimes there's a problem with a whole class. Most usually it would be if I'm trying to hold a discussion and all the kids are out of it. I'll just ask the obvious question if they read the material. Generally, they're pretty honest and say if they didn't read it. If not, I don't fight it. I'll give them twenty minutes. It doesn't do any good to stand up there and blab at them. I talk enough, anyway.

"The first year I was here we used BSCS, the blue version. I was not pleased with it. It's very difficult. In a different school where you could group your students a little bit more to reach a higher group of students . . . Oh, it's an excellent text; it just wasn't appropriate. I used to pore over it trying to figure out what the heck they were talking about. Somehow there was not a continuity of ideas. Laboratory-wise, it's very similar to what I use now. I liked PSSC physics. You really didn't tell the kids anything. It was very inductive. With the group I had at a previous school it was very good. They were eight bright, highly-motivated students. It's a risky text as to how much kids are going to get out of it. We decided here to go with something more traditional to try to reach a greater majority of kids. I've got useful ideas from those series. I still like the labs where you don't tell the kids what the answer is. I let them think about it and ask them questions and then respond to their questions. I think that's better because that's what the lab is supposed to do--give them an idea of how general concepts were first determined. If they already know what the outcome is going to be, they don't see the significance of doing the lab. In the classroom this kind of teaching is harder to do. I'm not good at it. I have difficulty asking the right kinds of questions. I can ask questions if I have something physical to look at. Just like today in physics class. I had trouble asking the right questions to get those kids to see what I wanted them to see in that problem about the car on the ramp, that that weight would act straight down.

"Once in a while, once in a great while, you see someone who is truly involved or engrossed in learning something. These are the really good times. They don't happen all that often. You know you're never going to get a whole class at the same time asking a lot of questions, not feeling this inhibition about 'she's a teacher, I can't ask a question,' but just interested in learning for the sake of learning and not because of next week's test. That may be too much to expect. Still, you have students who maybe go do something in science, who do well and enjoy it, and you have the feeling that you had something to do with that. Those are the longer term kicks. From day to day, the labs are more enjoyable than classroom work. I think the kids get more out of them. I think I like most interacting with the individual kid. There's students who'll tell you in class they don't know, when they do know the answer. In lab, they'll talk to you.

"All in all, this is a good place to teach. Basically I feel I can be the kind of teacher I want to be. I don't really feel pressured from any direction. There's no PTA. The school board is generous. I haven't asked for big things, so maybe it's been easy for them to agree to my requests. I don't know of any comment they've ever made about my teaching. And it's the same with the churches. Some places have had controversies over sex education. We teach it in health, and in biology when I go over the reproductive system I discuss contraception and venereal disease. We feel it's necessary for kids to know these things. We give it simply on an information basis. Most of the parents prefer that the kids get it here because a lot of them don't know much of this stuff. As long as you don't get into the moral aspect. The only time any of that came up was on the idea of abortion and I don't believe in it either. That's what I told the class, but at the same time it's there, it's available, and you should know what it is. Beyond that, you make the decision based on your family and your religious beliefs.

"Evolution has never come up as an issue. I don't know. My personal view is probably close to safe because I don't see any divergence between the theory of evolution and a religious viewpoint. I suppose I'm not really radical. Maybe that's the reason I haven't had any feedback. If I were an atheist, I suppose that might present a problem. And the students don't make it a problematic discussion either. Never had anyone do that. Here again, our students are pretty much of one mind. They're pretty closed in the ideas they have. I've hardly had any feedback from the community."

High School Science Classes

Chemistry I

Mrs. N. shows a girl how to get the area of a rectangle:

$$(10.0 \text{ cm})(15.0 \text{ cm}) = 150 \text{ cm}^2.$$

S:[5] *Do we have to do the problem that way? [she asks, referring to the parentheses and the units].*

T: Yes. And don't forget that you get squared centimeters. What about the significant digits? [She and the class count up the number of significant digits on both sides of the equal sign, Mrs. N. emphasizing they must place a line over the zero in the answer. She reminds the class several times about significant numbers. She reinforces certain procedures, trying to

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[5] In this and all other classroom scenes, S is student and T is teacher.

make them habitual, like to what digit you round off in chemistry if you have a .5.] On the test tomorrow, I don't expect you to recall the conversion from English to metric scale. OK, number 38. Jim?

S: I don't know.

T: What is the definition of density?

S: Mass per unit volume.

T: OK, I know I have a long fuse, but everybody seems to be talking about other things now. Could you give me your attention?

The class completes the review of homework problems and Mrs. N. returns yesterday's homework, observing that they had trouble with one particular problem which she then clarifies on the black board.

T: You all did very well, except a few of you misread the directions. Here's something to think about for the test tomorrow: [She puts a problem on the board.] What's the answer to this?

$$\frac{4.0 \times 10^5}{2.0 \times 10^{-4}} = 2.0 \times 10^9 \ldots$$

I'll make up problems. You have to pick out the correct answer. That means you must work out the problem. Those are the multiple choice. Then we'll have to name instruments used in the lab, for example, beaker, graduate, cylinder, burette, pipette, etc. You need to go back over experiment number 1 very carefully. Know how to make a bend, fire polish, transfer solids. There'll be some questions from experiment number 2. I'll give you a data table and you'll make calculations of the percentages of error and so forth. [The students groan.] Any questions?

S: Can you work out some problems like that one on the board?

T: OK, Lisa asked me to do a problem about absolute and relative error.

She works several problems while the class buzzes as it has all period, aroused by having got their class rings as well as by the prospects of the test.

Chemistry II

The topic is the preparation of alcohols. Mrs. N. asks questions about each line of information she has written on an overhead projector. The students take notes. Each line contains formulas and diagrams of molecules. She asks for the name of each substance. She covers up the material on the projector with a paper and moves it down one line at a time after she has asked a question.

T: Look at some specific alcohols. The simplest alcohol is methanol. What is the structural formula for carbon monoxide?

S: C double bond O.

T: *[She continues with a series of questions.] What do you have to do to balance that equation? . . . What are some of the properties of methanol? . . . How does it affect the human body? . . . What are some of its uses? . . . This is commonly called wood alcohol, by the way . . . What do you do when you make a ditto? OK, you dissolve off the surface and deposit it on a sheet of paper. In a true xerox, it's a photographic process and you need graphite. [They discuss the new machine.] OK, then, ethanol. What are some of its characteristics?*

S: *It smells sweet.*

S: *It gets you drunk.*

S: *You use it as catalyst.*

T: *In what? Does it [the book] say? I can't think of any instances. [A student reads examples from the textbook.] Where do we get it from? By what process?*

S: Fermentation.

T: Right. As Dave says, yeast secretes an enzyme . . . When you ferment, you also can produce CO_2. What do you use CO_2 for? What typical reaction?

S: Bread.

T: Right. Wines, beer, baking bread. There's a difference between yeast in bread and wine. What's the difference?

S: One doesn't produce spores.

T: Yes, but a practical difference.

S: Speed.

T: Yeah, but something else. What would happen if you try to make wine or beer from bread yeast? The bread yeast dies at 6% alcohol, but beer and wine go up to 14% . . . What is ethylene glycol commonly used for? You should all be using it right now.

S: Anti-freeze.

T: Yes. Why did we stop using alcohol?

S: Because it boils off in summer time.

Chemistry II

The homework for today was questions on the study guide for Chapter 17. The lesson begins with the answering of questions.

T: *What should butadiene really be called?*

S: *1, 3 butadiene.*

T: *We don't often refer to the 1, 3 because the 1, 2 is so rare due to the double bonds that it seldom occurs . . . Number twenty-five. [A student gives the answer and Mrs. N. draws the benzene ring on the blackboard.] Number twenty-five. That's a sneaky one on my part. It's not really in the book.*

S: *I got a* CH^3.

T: *Well. This is a Freidel-Craft reaction, named after the fellows that did it. [She refers to her own book.] I'm trying to figure out where the hydrogen comes from. Oh, yes, yes [she says as she remembers and goes on to explain.] It's also called methylbenzene or commonly toluene.*

S: *Where is that found? In glues and stuff?*

T: *Yes . . . Talking of xylene [she goes to get a bottle of xylene and passes it around to smell], I think you'll recognize it as the stuff in paint.*

S: *And magic markers.*

T: *Go get a can of ditto fluid from Mrs. Smith. We'll read the ingredients . . . OK, number twenty-seven. Now let's assume we read it with one butene. What do you get then if you react it with:* $\frac{AlCl_3}{HCl}$

S: *Butyl benzene.*

S: *Where does the extra bond disappear to?*

T: *Ah [she says and she explains].*

S: *Just moves the bond down. Right?*

T: *Right . . . OK, what is styrene used for?*

S: *Synthetic rubber, SBR.*

T: *OK, where do we get moth balls from?*

S: *Trees. [Students laugh.]*

T: *Coal Tar. What do we use the stuff for besides to get rid of moths?*

S: *Making dyes and resins.*

T: *What do three ring benzenes form?*

S: *Anthracene.*

T: *I don't have any examples of its practical use.*

This small class of five boys has been alert and interested all period. They had done their homework. They joke but not disruptively. They move along the entire period from question to question, finishing just before the bell rings. Mrs. N. elaborates the answers all the way through. There is no mere recital of answers.

To more fully develop the sense of Mrs. N.'s instruction, her study guides and test for chapter seventeen have been included as Appendix A. They suggest her view of what is important in the material her chemistry students studied.

Biology

When the bell rings there's a quick settling down to work. The talk is focused on the tasks involving their microscopes and the assignment. The temperature in the room is twenty degrees cooler than yesterday and one breathes more easily. The same pair of boys at the front of the room is talking and entertaining themselves, audible to the rest of the class, but ignored by all. They're the last pair to plug in their microscope.

Large colored letters pinned to the front bulletin board on a solid gold background spell out the slogan, "Know you're the best you can be." Extending across the room on the bulletin board space over the front blackboard is a sign "Tools of Biology" and in a row are hung a beaker, pipette, rack, etc.--fifteen or so little pieces of equipment. The back bulletin board is covered with colored pictures of flowers, all labeled, under the heading "WILD FLOWERS." Mrs. N. explained that even though the kids don't look at the bulletin board, she can't stand them to be empty. One table near the window is full of her own plants.

Mrs. N. is always doing something. She moves around softly and helpfully, available but not in the patrolling fashion of a teacher self-consciously doing her duty of being available. When not working with students, she straightens out the room yet keeping an eye on the class. She sees a group having trouble finding some creatures in a sample of pond water. She encourages them to look for larger specimens. She does this quietly, with nobody else in the room looking up from their microscopes but the girls having the trouble. Her movement, while constant, is not frenetic; it is soft, serious, and helpful. She smiles easily, often, and warmly. As she passes one table she says, "You seem to be having more trouble with that hair," but not threateningly. At 10:45 she invites the students to put away their microscopes so they can talk about what they've been doing.

T: *For tomorrow's quiz you should know the items we've been discussing in class--steps in the technical and in the research method and who uses these methods. What is the technical method? I'm asking you right now.*

S: *There's an outline to follow and you record the observations and report to someone else.*

T: *The research method?*

S: *Define the problem.*

S: *Collect information.*

S: *Make an hypothesis.*

S: *Then experiment.*

S: *Record your findings.*

T: *But, before you record . . .*

S: *Organize your observations.*

T: *In tables and graphs . . .*

S: *Draw conclusions.*

T: *Finally . . .*

S: *Prepare a report.*

T: When people repeat the experiment, then the hypothesis may become a theory . . . OK, the purpose of a control in an experiment--I'm going over the questions in the exam--lots of times we leave this out because we follow the technical method.

S: So an experiment has only one variable.

T: Yes, control everything but leave out one factor. For example, in photosynthesis, give two plants all the same conditions, but leave one in the light and the other in a closet . . . So those are the primary things you should know. OK, check the homework I gave you back. Any questions on the homework? OK, open your lab books. There's some items in it I'll expect you to know, like all parts of the standard compound microscope, what its function is, the wide field stereo micro and what's the advantage of it.

Biology

Yesterday, Mrs. N. passed out two journal articles: C. Hallowell's "The Coming of the African Bees," The Sciences (September 1975), a journal of the New York Academy of Sciences, and G. Alexander's "Bugging the Bugs," Natural Wildlife (August-September 1976). Today each student got a list of questions prepared for each article. They are given about twenty-five minutes in class to answer the questions before they discuss their answers. The class is absolutely silent as each student works on his questions. Mrs. N. is at her own desk grading papers.

T: I hate to interrupt, you all seem to be working so hard, but let's discuss the articles. Which one did you like best?

S: Bees [many students say].

T: I thought so. Why?

S: It's shorter and easier.

T: Any of you heard about these bees? Oh, one or two. [They begin to discuss the questions. They are factual, drawn right from the text.]

T: Why might the bees get here early?

S: Through smuggling.

T: Yes, because we're a greedy people and beekeepers would get them to go after profits. Should you lie awake at night and worry about those African bees?

S: No, because they might not get this far.

T: Right. They'll attack weak animals, small kids, and probably stay in the south . . . OK, you all liked bees, but I liked the other article because I'm interested in ecology . . . Now, the first word is badly misspelled. My typewriter never learned to spell. Innocuous? What does it mean? Any ideas?

Biology

The class sees a film which examines the physical and chemical properties of sulphur and iron, and of a mixture and a compound of iron and sulphur. After the film, Mrs. N. reviews its points by asking questions and writing students answers on an overhead projector.

T: *What are the physical properties of sulphur?*

S: *Hard.*

S: *Yellow.*

S: *Not attracted to a magnet.*

S: *Brittle.*

S: *Low melting point.*

T: *I hope you remember when he heated and melted it. What was unusual?*

S: *It got thicker and thicker.*

T: *What else?*

S: *It wasn't soluble in water.*

T: *What was soluble?*

S: *Carbon disulfide.*

T: *What's its density? Since you didn't write this down, you probably didn't get it. It's 1.9. What are its chemical properties as it reacted with other substances? . . . OK, it burns in air. You couldn't see it [because the film was in black and white] but it burned with a blue flame. It had to react with oxygen to burn.*

S: *It did not react with acid.*

T: *OK, those are the physical and chemical properties of sulphur. How about iron?*

S: *It's easy to bend.*

T: *That's called malleable.*

S: *Attracted to a magnet.*

S: *High melting point.*

T: *Right. I'll put down M.P. Did it dissolve in water?*

S: *No.*

T: *What else? Does it dissolve in carbon disulfide?*

S: *No.*

T: *It's density is 7.2. OK, the chemical properties?*

S: *Gave off gas.*

T: When reacting with what?

S: Iron and some kind of carbon.

S: Nitric acid?

T: No, but it was an acid. Hydrochloric. If we had pure hydrogen it would have burned, not popped . . . OK, they made a mixture of sulfur and hydrogen. How do we know it was only a mixture? What test did they do?

S: They could separate sulfur from the iron.

S: They put it in acid and got the same reaction as with the iron.

T: What would they have to do to produce a compound?

S: Apply heat.

T: Right. What tests did they do to show completely new properties?

S: Use a magnet.

S: Hit it with a hammer.

S: Ran another test.

T: What was it?

S: They put acid in.

T: Right. They bubbled gas through cadmium sulphate and it bubbled. So there is a difference between elements, compounds, and mixtures. When you get a mixture you alter things completely. Any questions? Comments? No. OK. Friday you'll have a test with open notes. Bring anything you want to use that's written in your own hand. You can copy down the whole chapter, but you can't use the book. Here's your quizzes from the other day. If you want do some extra credit that's also due Friday.

S: Whadja get, Eric? [whispers Eric's neighbor].

As in the case of chemistry, a biology study guide and test are included in Appendix C to portray more fully the nature of the biology course.

High School Students' Views of Science

Several students in grades ten to twelve were interviewed in order to learn of their perspectives on science, and of course, on math and social studies as well. Student comments on the latter two are provided in the appropriate section below. In general, students were asked to describe their school activities, speculate on their post-high school careers, and discuss what they believed science (or math and social studies) was about and what role it plays or will play in their lives.

Beth: A Sophomore

"I've wanted to be a vet ever since I was seven years old. We haven't had much chance yet to study animals, so far. I'm only a sophomore and I've taken earth science and now biology. But I plan to take all the science I can get, same with math. I'm not too inclined to read much, but if I do I mostly like animal nonfiction like this book I'm reading called Animal Kitabu. I wrote a report for English based on this book. I'm trying to get a point across to my teacher because he's a hunter. You see, I don't like the idea of shooting animals because they have no way to defend themselves. In biology the teacher has magazines around like Natural Wildlife. I look through them during study hall.

"In the past we mostly studied atoms and elements and photosynthesis. We started with the basics--structural forms and processes and chemical elements--and worked our way up. We studied molecules and atoms, the things that compose us. We haven't gone into anatomy or the organs yet.

"I think science is the study of, oh boy, simple and complex processes in living and nonliving things. It's the study of things we encounter in life; there's not many things you miss. Scientists study things differently than others because they have technicalities and they write out experiments. An ordinary person wouldn't think that deep down like the scientist does. Science makes you more aware of your surroundings so if you go outside, you don't see it as just another day, with animals, leaves, the sky. When you see a leaf, it's not just another leaf. You really understand the world more. Everything is intermingled and has its place. I've had this feeling mostly since the eighth grade on up, but more now than anything.

"In biology I'm working in a lab for the first time in my education doing an experiment. We did a little in junior high, but this is lab, and it's so labeled. Lately, we've been talking about cells, what happens if you do something to a cell, like put it in salt water, distilled water, how they react to stimulation, and how they react in certain environments. Next semester we study anatomy and I look forward to that. In biology we've started with the basics. I still wish we'd get to animals because whenever I think of science I think of animals and I don't get much chance to talk to anyone about my interest in animals.

"In eighth grade I remember we studied evolution. We got into an argument of evolution versus Adam and Eve. The more scientific people said evolution; some said you can believe in evolution and in God. But now scientists are breaking through. Science goes deeper into finding out the facts.

"Mostly this semester in biology we do lab work. You discover things that you wouldn't do in ordinary life. You look deeper. Then we read the chapter and answer the questions at the back. There's not much to them; the answers are right in order in the chapter. This work is useful for the tests and for understanding the chapter."

Steve: A Junior

"It doesn't seem like I've ever lived anywhere else, but really I've only been here since third grade. I've got one more year to go after this one and then I'll go to a junior college to study carpentry. They get you into an apprenticeship. You go to school for two years, then serve as an apprentice for four.

"This year besides my courses (U.S. history, technical math, English, speech, art, and P.E.) I'm out for cross country, football, basketball, and track. The last two years I was in Science Club, but not this year. There weren't many kids in the club the first day so me and my friend decided not to enter. It's more fun when there's more kids in because then we can talk to kids about our project. Kids often know more than the teacher. For two years me and my friend got a third on our science fair project when we thought we should have got a second.

"We began science projects in the seventh grade because of the teacher. We liked him real well. He helped us along and got us real organized. There was a science club in junior high. I liked talking to judges at the fair. We told them all we knew, but they said we needed more definitions. We took their words that needed definitions to our science teacher and even she didn't know some of the definitions. Some of them were just over our heads. Maybe next year I'll try again.

"I've taken Earth science and biology, but no science this year. Biology was rather tough. Maybe next year I'll take another science. I'll ask kids in my class about which ones they thought was best, what they got the most out of. Mom wants me to take more science, maybe because she's interested in plants and she wants me to learn more about greenery. I don't know if I'll take any more social studies. I'll wait till the end of the year and talk with Mr. T. He helps me pick 'em. He thinks about what will relate to carpentry. I've been interested in carpentry since I was a freshman beginning in industrial arts.

"To me, science is the study of life around you, the environment, different animals, the insides of you, the study of yourself. No two people can look at the same thing and get the same picture. Scientists look at things different, they take more time to look, while others don't really care. Their opinion overrules nonscientists, but this shouldn't be. There's different theories and theories are made to be broke. Not just one certain theory; each year they're broken. I don't have any evidence, but that's what I believe.

"I think science helps you find out about yourself, what you can and can't do with your body. One chapter I remember reading talks about bones. You learn what you can consume, like carbohydrates, and what's bad and good for you. It helps your little sister in junior high because you can help her with her work. I eat more bread and milk than I used to since taking biology when we studied calories. If you're healthy, you live longer, and I want to stay around as long as I can. I'd like to have done more experiments in biology. In Earth science we only did one experiment all year. We had lots of equipment, but didn't always put it to good use."

Tammy: A Junior

"My mom's a registered nurse and I've wanted to be a nurse ever since the fourth grade. Next year when I graduate, I'm a junior now, I'd like to go to the U. of I. and study psychiatric nursing. Science fascinates me and it always has. I've been in the Science Club ever since seventh grade when I entered my first project. I don't read much outside of school, but I like science fiction and Star Trek. This year I'm taking Chem I, U.S. history, humanities, Algebra II, and Spanish III.

"To me science is the discovery of things you didn't know before. For a one word description, it's discovery. It's also learning about everything and anything that is in the universe. Scientists are probably more methodical than ordinary people. They are very organized and go about things more calmly in their daily life. In the lab you need to know what you're doing. Science is very, very special.

"For last year's science fair I did a project on psychological patterns in small kids. Got a first in the state. We interviewed kids, all of 'em first-, second-, third-, fourth-, sixth- and eighth-graders. We asked opinion questions about God, lying, what parents meant to them, symbols of authority. Mr. T., our counselor, helped us to develop questions that kids could understand. We interviewed before and after school, during free time. Teachers were very cooperative.

"This year I think I'll do a general paper on archaeology, how it's changed, and how it'll be useful in the future."

George: A Senior

"I've lived here all my life and I probably won't ever move away. My great grandfather came here from Germany to farm. I'll probably study diesel or auto mechanics at junior college after I graduate. Someday, though, I'll become a full-time farmer. I collect guns and I like to hunt and trap. I'm always fooling around with cars, doing my own maintenance, tune ups. I subscribe to gun magazines and Car and Craft. This year I'm taking P.E., consumer education, family living, sociology, and agriculture. No science or math. I've already had Earth science, biology, and botany/zoology and I took algebra and plane geometry in my first two years.

"Science is the study of what makes things tick, like earthquakes and volcanoes, the composition of plants, the manufacture of food, and taking animals apart like night crawlers so you can study organs. In science you have to observe; you remember better this way. You're more detailed if you're a scientist, I imagine. We were urged to observe carefully. Observation and research are linked. You have to observe in the research you're doing. In research you're trying new and different ideas. Science teaches you to observe conditions more carefully. For example, if you're working on an engine, you may know where the piston goes, but you need to get things in the right order. For right now, Earth science and zoology are useful to some extent. Botany isn't."

Bill: A Senior

"I'm a senior and I've gone to school at BRT since kindergarten. I'd like to be some sort of an industrial engineer so I've taken all the math and science I can. This semester I'm taking physics and Chem II, but I'm busy with lots of other things in school, too, like I'm manager of the football and basketball teams, play in the band, and I'm in the Science Club and the Student Council. Out of school I work on my car and motorcycle. I'm a Ford man; I got the repair manuals and do all my own maintenance. We've got a shop at home for wood and metal working so I can ship up parts for my motorcycle. Anything I can make, I do, rather than buy it. I don't do a whole lot of reading, mostly on things I need information about. I'm a Star Trek buff.

"What comes to mind when I think of science? Interpreting things around us, their makeup, the way the elements behave to make some practical thing. Discovery--that's what comes to mind first. Elevating mankind in general, I suppose. I think back to chemistry and physics, when they first started and the way they changed civilization. The past few hundred years things went straight up--discoveries showed us things to use, the light bulb, the jet age. In junior high general science we talked about these things.

"I don't know that the science I've studied has any particular value for me now outside of school. I suppose it has, but I can't pinpoint anything. Guess it's made me more aware.

I notice rock formations and stuff since taking Earth science. As the year goes on in physics, I'll probably use more of it, things like forces, acceleration, and vectors.

"I take everything I can, and it doesn't cost you that much to learn it. Learning is like an investment; it's the best thing that you can do. I think more kids should take these courses; won't hurt 'em to take the courses. It's silly to sit in a study hall."

JUNIOR HIGH SCIENCE

The last three years at BRT's junior high, comprised of grades six to eight, are taught on a departmental basis. Only the fifth grade is a self-contained class. Since the school is six miles away from the main building in Rhodes, its teachers are a group unto themselves. They do not so much feel isolated as they feel apart, having formed good, cordial working relations with each other over the years. However, unlike most junior high teachers, Mr. O., the science teacher, is involved with the high school because of his job as assistant coach of basketball and football. His background and observations about science are joined with those of several grade school teachers to complete this characterization of science at BRT.

Mr. O.: Junior High Science Teacher

"This is my fifth year as a teacher and my fifth year in BRT. I teach science most of the day and I'm an assistant coach in football and basketball. Originally, I'm from a small town--there were 300 students in my high school--and I went to Eastern Illinois University to study zoology and botany. I want to say I got nil from my college education courses. I've reread my notes to look for help in them. Nothing. If I go back for a master's, I'll do it in science, not education. Outside of school I like activities associated with the outdoors like hunting, fishing and trapping. I work with a neighbor to trap muskrats. My schedule is busy, but I read every chance I get--science journals, science fiction, that's what I like. And I subscribe to People and sporting magazines. I get old copies of Scientific American from Mrs. N. at the high school. As for organizations, I belong to the Illinois Education Association, but I'll drop it this year.

"My dad is a science teacher. He taught in my high school--I took courses with him--and he's still there in my home town. I admire the way he deals with kids on a one-to-one basis so the kids feel they're worthwhile. As a teacher, he uses traditional methods, always trying to tie in reading and lecture materials. Students will read a chapter, answer questions on it, discuss the questions, and investigate. It's not open or individualized.

"I wanted to teach science because I'm really interested in nature and seeing how things interact. It fascinates me how the natural world affects civilization. The major advances in science--they overwhelm me. I try to point this out to the kids. I try to bring it in in all units I teach, to impress kids that the world is changing from a natural point of view, you know, geological changes, climatic changes. I'm interested in improvements in technology that change our life style, things that the kids take for granted. Kids need to learn to appreciate. They're sharper than we think they are. I've talked about corn and its evolution from a small cob to its present size. The kids got a kick out of that. I try to relate all things to life outside the classroom.

"In my first year of teaching, I was strict. I followed straight lecture with lots of paper work for students. Since then I've relaxed, but I'm still very traditional. Now for the first couple of months we work in the textbook and for the rest of the year, it's mostly lab. We use ESS materials. I get some telephone calls when we do the lab work because parents wonder why no book is brought home. There's no need to. The students do their experiments and write-ups right in class. I don't like to see students take home books; the school day is long enough. I like to get all my work done during the day and not after the school day.

"In the junior high curriculum at the sixth grade we emphasize behavior. We study meal worms, a little biology, electricity, and astronomy. In the seventh grade, it's strictly biology--ecology in the first quarter, then conservation education, the human body, and animal anatomy. The kids are surprised to see the comparison between the insides of a frog and a man. Earth science and chemistry are what we concentrate on in the eighth grade.

"There are some general concepts I think are important. In sixth and seventh grade, we try to see the interdependence of things, that things on earth are not totally separate from each other. In eighth grade, it's natural events and how the world is changing, how the earth is constantly changing, as well as civilization. In chemistry, the concept is to get a perspective of how things are put together. For example, this desk and I have something in common--particles. It's difficult to get concepts across. At this age, kids like generalities. They have misconceptions about the natural world that come from cartoons.

"There's one important attitude that I stress. It's appreciation. It often comes out later when students are in high school and they think back. I try to get them to see that we're here on earth for only a short time, so we need to understand the world a little better. They can't just get whatever they can get out of it. They have to think about why they're here and develop an awareness. People should see, be aware, and be in it--life, everything living. 'Don't go through life just to go through it,' I tell them. 'Get something out of it.'

"I'll tell you what I like most about teaching. It's being able to communicate and show kids, 'Hey, somebody likes you.' Parents put pressure on them. At this stage their body chemistry is changing. They've got choices to face. If I can get a kid to smile when he doesn't want to smile . . . . People cared about me when I was growing up and I like to pass this on. I like to show kids that somebody above the age of fourteen likes them. Sure, there's frustration, like over getting kids to understand, to see what's happening. They turn off or forget, usually around Thanksgiving, Christmas, and the last few weeks in March. I'm tired then, too. I get tired of searching for new ways to do things, especially after the football season's over, but this passes.

"I'd love to get all kinds of things if I had the money. I'd give kids more materials for investigations they can conduct throughout the whole book. I'm still developing. I've changed what I teach, but not how I teach. Some kids want to do special things of a scientific nature. I'm sorry not to have the time to help out. There's not a lot of resources here in BRT, places to turn to. I've thought of giving over a week to projects, but I'm afraid they wouldn't come up with projects, and I couldn't think of one for everyone. Some of our junior high kids do prepare projects when they participate in the science fair. Used to be that all the kids had to have a project. I don't believe in that. I can't help with organizing the science fair stuff until the middle of February because I'm working with basketball. Many kids are very busy, anyway, because they're in sports and the band and they don't have the time.

"My biggest complaint about teaching is the frustration thing. It comes from motivation. I don't know if it's me or them. I don't understand why kids are not more motivated. Part of the answer must be in me, but it's hard to look at yourself and see other than what you want to see."

GRADE SCHOOL SCIENCE

Mrs. B. and Mrs. T. are two of the four lower grade teachers at BRT. They each teach science in their own way, unconstrained by the need to coordinate their efforts with each other or with the next level of schooling, the junior high. At the primary level, each teacher feels free to be as formal or informal as she likes, emphasizing science only to the degree that she is moved by her own tastes. Accordingly, Mrs. B. probably emphasizes math and social studies more than science. Mrs. T., the second grade teacher, is shown at work in her classroom, engaging her students in a science discussion of the sort that occurs with some frequency under her direction.

Mrs. B.: Fourth Grade Teacher

"For science I still believe in a hands-on approach to learning. Kids can't take a concept and read about it, even if they're interested in it. They need to apply it. I see science as a broadening of general knowledge about things that relate to the natural world, getting into physical things like the weather, which some students really want to understand. Science is most useful if it is something they can apply. Take symmetry. It came up in one of our lessons but since it's not in their lives they're not interested."

Mrs. T.: Second Grade Teacher

"At Illinois State I studied home economics and general science. I'm grateful for my science background. For example, if we have a reading unit on animals we will branch out more than required for the reading and get into the beginnings of research. Right now we have a story on the weatherman. I asked them to watch a weatherman for Monday and to bring maps to school. I try to make the students aware, to observe, to see. I like to tie in what we study with their home life, like a recognition of the seasons as they relate to what daddy does in spring and fall.

"On the primary level I don't teach for grades or testing. I don't feel this is the way to do it. It's open-ended. Exposure is important. A kid will become aware and will know he's heard something before when it comes up again. I teach kids the thrill of seeing things. During sharing time one lad told of seeing a red fox. His eyes sparkled. He wanted to share it with us. This is a science observation, an awareness of the wild creatures, where they see them. We'll look up the common ones, the number of babies, the food they eat, where they live. We spend more time on the things they see.

"When we had fossils in the room, the kids enjoyed them. They examined them, looked them up in books, and talked about them. This is primary science to me. I don't agree with Jerome Bruner. You might be able to teach anything to any kid, but it's not worth the effort. I think they should become more aware as things are familiar to them. Then, they can get more later.

"In the second grade, the most important thing is that we should spend half our time on reading and related activities. They need reading to function in our school system. Of secondary importance is math. From my point of view, we might as well be reading things that talk about science. Little boys don't like fairy tales. Science stories motivate them better. Our reader contains much science and I chose to pull it out. We have a story coming up on road construction. We'll discuss the equipment. Kids out here are familiar with large equipment. They understand bulldozers. We'll talk about dump trucks and which end does the lifting. They know because they've watched them operate. To me this is just practical science. We discuss the work of the roller and why they do it so many times. They'll bring their toy equipment used in road building, their bulldozers, dump trucks, etc."

Mrs. T.'s Second Grade "Science" Class

T: *Why do the leaves turn color?*

S: *Because it's cold.*

S: *It's a sign of fall.*

S: *Because there's no sun.*

S: *Because when winter comes, leaves will be gone.*

T: *When will new leaves come?*

S: *In the spring.*

T: *Why do the leaves turn colors?*

S: *Because of the cold.*

T: *Kenny, sit up, I like to see your face . . . OK, we just want to hear what you think about why they turn pretty colors this time of the year. We've heard because it's cold.*

S: *Because it's October.*

S: *Because it's getting too cold for them.*

S: *Because it's Halloween.*

T: *Do you think everybody celebrates Halloween?*

S: *Noooo [students answer in a chorus].*

T: *OK, now, what about the leaves?*

S: *Because of the sap.*

T: *What about the sap, Sheila?*

S: *The sap turns colors on the tree.*

T: *Where is the sap?*

S: *In the leaf?*

T: *Susan?*

S: In the tree.

S: In the leaves.

T: Is sap on the leaves?

S: It's in the middle of the tree, but it starts to come out because there's too much in there.

S: The sap is in the limbs and the limbs fall off.

T: Do many fall off this time of the year?

S: No.

T: Do all trees lose their leaves?

S: No, sticker trees don't. The ones that have like sticky things. They hurt.

T: Which trees are you talking about?

S: I mean the green one on the playground.

T: What do you call the leaves of an evergreen? Because they certainly don't look like leaves.

S: Stickers.

T: They do have another name. Think of your Christmas tree.

S: Pine trees.

T: Yes, many are, but what do you call the leaves or stickers? Do you remember, Susan?

S: Pointers.

T: How many of you get real Christmas trees? What do you call the things that fall off the tree and mom says it's time to take it down?

S: Branches.

T: What do we call 'em?

S: Stickers.

T: Did you ever hear the word needles?

S: Awww.

T: Do evergreen trees lose their needles? Some do but not all when they're living. These trees do. What kind of leaves do we have there? [She holds up a leaf.]

S: Maple.

T: What is this other one?

S: Sassafrass.

S: Tulip.

T: *Yes, tulip poplar. Well, it's time to go outside.*

T: *Do you know what these are, children?*

S: *Oak.*

T: *They aren't so pretty, are they?*

MATHEMATICS IN BRT

Mr. L.: High School Math Teacher

"I've been a teacher for twenty-two years, fifteen of them here in BRT and the other seven in the next town just south of here. In fact, I've been living and working in small towns all my life. I'm a preacher's brat. My father was associated with the Wabash Conference of the Free Methodist Church and he was transferred from town to town on both sides of the Wabash River. I suppoce I was a little upset having to move my senior year, but I don't really recall too much about being upset before then. In fact, the only thing that disturbed me about moving so often is I missed taking chemistry. The school I was going to graduate from was teaching physics that year, chemistry the year after, and I'd already had physics.

"I guess you could say I came from a family of teachers. My dad, of course, I'd say he was a teacher and mother was teaching at the time she met him. And I've got one brother and two sisters, all of them trained teachers, though my brother ended up as an administrator.

"At heart, I'm an outdoorsman. I get a great deal of satisfaction from gardening and yardwork, and I love hiking and bicycling. Right now during the fall it's mainly bicycling around town. The kids around here will tell you I'm a hiking nut. I like to hike out in Colorado. Now last Saturday I was in that Walk for Mankind that covers twenty-five miles. It's a challenge and I enjoy it. Since about 1960 every summer we've taken at least one trip to the West. And we've never failed to have a garden. Right now I have one which is about forty by one hundred feet.

"Besides these outdoors activities, I'm constantly reading. I try to mix things up, but I think I tend to read fiction more than nonfiction. I like westerns and spy stories. I read the newspapers quite a bit, also magazines. I'll occasionally pick up some of my wife's magazines, Psychology Today being the one I read most, I suppose. Of course, I do get Arizona Highways which I read all the way through and a little magazine by the name of Colorado. Keeps your Western interests alive. The Arizona Highways is once a month and the Colorado, well, I guess it comes around every three months. I used to get the Mathematics Teacher and I tried to make use of it in the classroom. Most of it was so beyond the kids that I found for me to sit down and figure things out was good recreation, but to try to revamp it as something for the classroom just wasn't quite worthwhile. I got Mathematics Teacher up until this year. We've cut out everything that we didn't think was essential till we get our footing with our daughter in college. One of the things we cut out was subscriptions and also memberships in various teacher's organizations. If my wife and I both belonged, it would be in the neighborhood of $300. We still subscribe to a couple of newspapers. It's the Denver Post on Sundays and a daily newspaper out of Champaign. Sometimes I'll combine reading and TV, watching shows like 'Baa Baa Black

Sheep' and comedies like Bob Hope and Dick Van Dyke. I'll watch sports, but very seldom throughout a whole game. There's nothing that I have to see. I like to watch TV; it's an escape.

"I went to Greenville College, a four-year school with about 500 students. Everybody knew everybody else. The faculty was quite relaxed with the students. There was a lot of camaraderie. I think probably they considered teacher-training as their prime function. We got our actual teaching experience in Greenville high school. I think probably what carries over from those days is I've always tried to set high standards for students, maybe too high for a lot of them. Another thing that carries over is negative, I suppose. One of the classes that I least like to teach is where I had my student teaching, in general math with the kids of lower ability. I've never quite felt as comfortable with them as I have with some of the others.

"In general, I think I would require two years of high school math. Now we only require one. I suppose if we had two required years you could set it up as a two-level program, the one level being for those primarily interested in mathematics, where their subject areas for further study are going to be related to mathematics, especially towards higher education which would be essentially what we've got now. For the other level I would probably require a general mathematics course and then sort of a combination of algebra and geometry so students could get a feeling of other topics besides just what we consider to be traditional arithmetic or something like that.

"At present students can fulfill their requirement by taking practical math or algebra. The basic thing that I try to get across in practical math is the idea of being accurate. Also that all of life can be related to mathematics. So all of the subject areas that we try to get out of this general math course will be things that relate to their own experiences. For example, if they're going to be involved with taxes, paying bills, writing checks, balancing checkbooks--all this sort of thing. I really think it's probably necessary for the majority of people to know these things. Of course, we now have the required consumer education course and several of these areas are covered again, but we've always found it useful for the students to have some idea of those things before they get to consumer education.

"In algebra we talk about the structures of mathematics, that there are patterns that you can look for. I suppose that what it boils down to is it really involves a lot of thinking as well as manipulation of terms and numbers. I don't know how to explain it any further, except in those terms. Structures . . . if you want to call them rules or properties or whatever. A very simple example is what we call the commutative property. If you want to add two numbers, it doesn't matter which you chose first and which you choose second. You should get the same result. So you can set up a whole structure of rules and regulations that will go for the algebra. And you can carry it over into geometry and Algebra II and senior math. Rules are the basic structure that are set up.

"In addition to the required courses, I teach a number of nonrequired courses, ending with senior math. The majority of students in them would be those who are preparing for further academic work. A lot of them would also be interested in science and see the relationship between the math and the science. Many have an interest in math, as well. Some students, by the nature of their intended life's work, are encouraged to take further math. Others, I suppose, just end up taking the same courses as their buddies.

"I think a lot of students are strictly looking at their achievement in terms of a grade. They may be motivated, maybe from home, to get certain grades so that other things good and nice will happen to them. A lot of them are thinking in terms of 'what do I have to accomplish day by day,' and to them that's all it's about. Others look at math from the viewpoint of, well, I've got to get through this, it doesn't mean anything to me, but here is the method and the example and I'm going to do it and that's it.

"I don't get too much feedback from parents one way or another. Occasionally, you'll get a negative report. I'll give you an example. One student's parents called last year because they thought this student should have gotten a higher grade since so and so did. I informed this parent that in this particular course we did not grade on that basis. They could not understand that at all. I tried to point out to them that most courses are based on competition between students. That this wasn't always done, they weren't ready to accept. The only real feedback as far as methods is concerned are your students. Some that have gone on will mention that they did certain things that were useful to them. Of course, you get a negative side where someone will say, 'Well, you seem to understand it, but you don't explain it well enough for the students to understand.' My only retort to that is that if the student doesn't understand, then they must ask the question. They must ask will you explain it again, will you explain it in different terms than you did the first time.

"Most parents, of course, won't voice an opinion. I think the general one that I get is, 'Oh, I was never very good in math.' I hear an awful lot of that. I suppose I should ask the question, 'Well, why do you think you didn't do well?' I look at this response as an excuse. I'm sure there are areas where everyone is weak. I recognize that. But a lot of times they say that and it's just an excuse. To a lot of them it's easier to say, 'We didn't do well, so why should we expect our kids to do well?' I think many parents have too low expectations for their children. On the other hand, maybe I expect too much.

"Our whole curriculum here followed a new math approach soon after the books came out. To me, new math is new methods, but not particularly new content. More recently we've gone to metrics, but this is not new, it is just a new emphasis. New math got down to more rigorous math, looking at patterns instead of working . . . Take multiplication. Instead of just multiplying two numbers, we break it down. We write 25 as 20 plus 5 and multiply it by 4, each number by 4, so we can show we get 100. This way students learn the patterns of math. It didn't bother me that much to switch to new math because I was really into the math more, being it was my major and I had had additional work. It was not traumatic for me as it was for other teachers who did not have so much background in math. My methods did not change so much. Students had trouble accepting it, however.

"What I like best about teaching is naturally when I get students who perform well, especially if they carry on beyond high school into college work. It also feels good to grade tests and see the students do well.

"I like most to teach precalculus and then trig. I suppose it's because of the weeding out process. Generally, students who reach the senior year are the most capable ones. They have goals, they know what to expect from themselves and from me. There's a camaraderie, a mesh of ideas and personalities. So I feel most comfortable with them. They know I expect a lot out of them. The good ones will give you more the more you expect. What bothers me the most is the kid who elects to take a course and then does nothing with it.

"Neither the board nor the superintendent limit the way I teach. If my textbooks are not up to date, the board might urge me to get new ones. My senior math book has 1940 as the first copyright and 1955 as the next. The book I use for reference has a 1964 copyright. The materials are basically the same in the new and the old books. If new material is available I'll add it to old stuff from the 1955 book. So my students don't lose out on the new materials.

"Things might be different if I worked in a larger school. They set up programs for teaching students, the college bound, etc. This could make a difference. My daughter learned chemistry in high school from a teacher who went at a rate that allowed all the kids could understand. She did not complete the text within the year's time. So at college she had trouble with chemistry for the first nine to ten weeks. I hope we push kids hard enough so they have the background to go on. As far as discipline goes, the large classes in big schools could mean that some students do not get the material. Here there's not many disruptive kids.

"I suppose I've changed my teaching methods from time to time. I guess you should change each year when different classes come in. I've changed techniques but not great changes. In geometry, to cover important material, I demonstrate a great deal on the blackboard. I've always done this. From time to time I tried to let the students do this, but it's too frustrating to me. They try but the results are not predictable. So I do it. In general math, the kids are willing to work the problems on the blackboard, I suppose because the problems require simpler procedure. This is OK with me. It doesn't take so much time to do this. Part of the beauty of math to me is its abstractness. There are consistent patterns. It doesn't call for that much change in the way it's taught or in what's taught. Content-wise it has not changed; it's just emphases that change occasionally, either out of necessity or for the sake of trying to see if a new way is better."

High School Mathematics Classes

Algebra I

Students are counseled to take either general math or algebra on the basis of their scores on a math aptitude test. If a student is slightly below the cutoff point and he really wants to work, explains Mr. L., then he can be admitted to Algebra I. Also, parents can come to school and get their children's schedule changed to one or the other course. "It's their choice." In general, students opt for one course or the other depending on whether or not they are bound for college. The textbook used in Algebra I is Algebra by R. E. K. Rourke and H. W. Sye. Its preface indicates that the book is an "introduction to algebra for capable students" and that the "authors have sought to combine the best of the new with the best of the old."

The tone of Algebra I differs markedly from that in technical math. Here the students come to class having all done the same exercises. When the bell rings, the hand waving begins. Mr. L. takes each homework problem in turn, the students waving their arms to be called on for the answer. One or two students seem always to know the answer and Mr. L. will recognize the same student in quick succession. As the class continues, the number of hands raised markedly declines. Then the teacher's deep, robust voice is heard increasingly as he feels obliged to provide extended explanations to the more complex problems. If a student offers the incorrect answer, Mr. L. calmly explains how to arrive at the correct one. He does not scold or scorn those who appear not to understand, but remains outwardly calm at all times, seeming to enjoy those occasions when an elaborate problem can be worked out on the blackboard. It is not uncommon for him to smile and say, as he approaches the more difficult problems, "OK, now here's a little tougher one," suggesting a sense of pleasure as he anticipates the work associated with such problems. If a problem does not appear to have troubled anyone, he will ask, "Any problems with this one?" and hearing no response, he will move on to the next one or, possibly, add a comment designed to assure understanding of the general point. While discussion of the homework is proceeding, some students, who did not do the homework, write down in their notebooks the correct answers that are read out either by the students or by the teacher. On one occasion, a student asks Mr. L., following the explanation of some point, "When would you use something like that?" Mr. L. responds, "Very seldom. Mainly it's the thinking and the manipulation process that is important."

Once all the problems have been discussed, Mr. L. assigns the next day's homework, invariably leaving time in class to begin the new problems. If it's a Friday, students may protest their weekend assignment, pleading a big football game or a too busy weekend. Mr. L. is unmoved by such protest. In the time remaining in the period, students break into pockets of buzzing; some of them, however, do use the time to begin their work.

From time to time, the students are given a quiz, such as the one in Appendix D that was taken early in the semester when the work was devoted to the study of sets. Such quizzes are meant to check the degree of mastery over material studied and as a revew for the more comprehensive tests. The results of such quizzes are not always recorded.

Technical Math

This course is taken by juniors and seniors who are not too proficient in mathematics. It begins with the fundamental processes of addition, subtraction, multiplication, and division and is designed to have a strongly applied nature.

Very early in the semester, Mr. L. prepared and ran off contracts for this class, seeing them as something different he could use to motivate the class. He is not using contracts for any of his other classes. A copy of the contract follows:

> I, ____________________ contract to do a minimum of ______ tests during the ______ quarter with an average of 75 or better for a grade of D.
> If I do ______ tests, with an average of 81 or better, my grade will be a C.
> To obtain a B grade, I must complete ______ tests with an average of 87 or better.
> If I wish to have an A, I must do at least ______ tests during the quarter and have an average of 93 or better.
> In addition to the foregoing, I realize that my notebook should be in satisfactory condition and that I will have conducted myself properly in classroom activities.
> I should fully understand that each test less than that for which contracted will result in the lowering of my grade one step . . .
> SIGNED: ______________________________ Date ____________________

The students were very much aroused the first day they received their contracts because different amounts of work were required from each student in order to obtain the same grade. The class did not ask for an explanation of this arrangement and Mr. L. did not offer one. In fact, however, a very definite plan was followed to determine the amount of work a student should do. Each student's score on a standardized math aptitude test was added to his IQ score and divided by two. The result was a score that was used to determine the number of tests a student must take to get a grade of D, the number of tests increasing by one for each higher letter grade.

Once the students understand this new system, they enter the math room, chat for a while, and then without comment from their teacher settle down to work. Each student works at his own rate. Some are obviously intent on completing the assignments, their faces bent over their books, their pencils moving rapidly. Others talk, work, talk, work, in a not always productive fashion. The nonwork noise ebbs and flows, sometimes reaching a crescendo. At a particularly loud outburst, Mr. L. may look up from the work he is doing at his desk. When a student finishes a set number of the exercises, he can come to Mr. L. and ask for the appropriate test; the test completed, he moves on to the next set of exercises to prepare for the next tests. Occasionally, Mr. L. walks around the room glancing at the students' work.

High School Students' Views of Math

Beth: A Sophomore

"I'm taking plane geometry this year. I can't see what it'll help you do beyond school. As parents you may do algebra, but there's no possible way that I see how plane geometry helps. I know it does, but I can't think how it does. That's the main problem. Algebra is more helpful in situations where you have to calculate different numbers.

"Plane geometry is not my favorite subject, but they say you should take it if you want to get into the U. of I. I don't know what I'm getting out of it. I can't really say anything now. You study and cram for the tests and that's it. I can't remember back to what we did earlier in the semester. The teacher knows what he's talking about, but I'm not really sure I know what I'm doing. He's over my head. You've got to do it on your own. If you ask for more explanation, it gets even more complicated. You can't get away from the technicalities, so you really have to work to understand. I want to understand it, but it's hard. I got a B for the first quarter. I want to work up. Now we're on geometric proofs and that goes back to algebra which I pretty well understand. I got along well in algebra last year.

"So, I'm not a bad student, I just don't have that much interest in it. I didn't have more interest in algebra, it just came easier. So far there hasn't been much connection between the math and the science I've studied. There was in eighth grade in conversions of Fahrenheit and centigrade. This is easy to do with a formula. In high school there's been no connection.

"Here's what we do in plane geometry. We go over the assignment from the night before and get a new one. The teacher sometimes will explain what we're going into, but not always. This may take the rest of the period and, if not, we get time to work in class. We get an assignment every night. They're quite lengthy. It would be better if we got shorter assignments and not every night. When we come to a new topic, he should give us a break. Do a topic on Monday to Wednesday, give a breather on Wednesday night, and begin the new topic on Thursday. I don't have as much homework in any other subject. It takes at least one hour. It's not collected, only once in a while to catch us, so I don't do it that much. I look it over in study hall, but I don't really write it out. That's probably my problem. Only a few kids do it every night. I understand when I see it on the blackboard, but not when I do it at home."

Tammy: A Junior

"Mr. L., our math teacher, he can talk above our heads, but we can joke with him and say, 'Get down four feet to where we are.' He takes this well. At the end of class he'll look around and say, 'I got a joke.' I have fun in math because he makes it fun. I'm about a B student. He never loses patience. If he sees our blank faces, he'll explain it over and over.

"I think it's easier to learn in a small school because we know all the teachers personally. I can go to teachers and easily ask them something. You can't do that in a big school. BRT has helped me to want to learn. We're on a friendly basis—person to person, not teacher to student. We call all of the teachers by their first name, but not in school. After school and out of school it comes easy, though more for girls than boys, I think. I don't want to move away. This is my school. I plug for BRT. This feeling is common, especially among girls. We always pack the spirit rallies. The feeling comes very much from the teachers' attitudes. They're not looking for trouble; they're willing to help us. Also the superintendent--he's good and fair and we respect him. Teachers here are friends to me, not symbols of authority."

George: A Senior

"Science and algebra and geometry are just teaching you to think, even if you don't understand. It imprints in your mind to use a process, to think for different situations that you come across. This is what I feel now when it's over and I look back. Sometimes you think you're not learning anything, but I imagine most kids see it that way. I do. A few never see it as any value. It sure won't hurt a person to know about science, because the more he knows the better off he's going to be.

"I took basic math. That's problem solving with multiplication, addition, subtraction, and division. Also algebra and geometry. They're still problem solving but they go about it with a different view or attitude. It's just not quite as apparent as basic math.

"Math--I couldn't get by without it. I use math all the time in farming and to a certain extent in all I do. For farming, you got to figure your percentage of food, fertilizer, seed, etc., per acre and the costs per acre. I keep a record of these things because of FFA, but also because I rent land from my dad. Algebra and plane geometry aren't necessary for farm calculations. If you have an irregularly shaped field and need to figure its area, then maybe plane geometry is useful.

"My dad, he requires us to take accounting and to take at least two years of math. There are other dads who also require their sons to take plane geometry. My dad never said anything about taking science courses.

"Math is probably more important in the future, than now. For most occupations a person plans to enter, a good knowledge of math is needed. I've got no regrets about taking it. I just wish I'd learned a bit more. Algebra seemed awful tough. I wish it were taught slower. Slow it down some. Use more examples. We'd get an example and then move on to the next theorem, but I think we'd be better off if before going on to the next theorem we had more examples of the old one. In math, we'd have an assignment of problems every day. We'd go over 'em in class. There'd be questions and he'd explain more. Then we'd get a new assignment for the next day which the teacher would explain before you did the new problems.

"I learned some, but not as much as I could have. I could have paid more attention, asked more questions. I thought about this all the time. Four people in the class had a good idea of what was going on. Seven to eight knew half way what was going on; I was in this group. Others didn't understand anything. We went at a fast pace. It seemed that questions would slow down this pace. The more you know, the better you feel about asking questions, and the less you know, the worse you feel about asking questions."

Steve: A Junior

"I'm taking technical math this year. I had modern math in my freshman year and no math last year. Mr. T., our counselor, said to hold off on technical math in my sophomore year. I'm sorry I did it this way because it was easier last year when students didn't have contracts like this year. The contract makes me work harder and faster than I can go. I'm not that great at math; I'm down to the C and D area. The stuff we're doing uses instruments that I never used before. I never was too good working on fractions. This stuff'll be good for carpentry, though."

Junior High Mathematics

Mr. C.: Junior High Math Teacher

Mr. C. has a gentle, kindly appearance, yet he appears firmly in control of his class in the terms favored by teachers in the junior high. That is, students are quiet and orderly, but not cowed by authority. They respond to questions, stir when a joke or gesture by student or teacher animates them, and are quick to settle down when Mr. C. quietly remonstrates with a "Get busy."

The eighth grade, as taught by Mr. C., proceeds by questions. "What is the perimeter?" "How should we carry on?" "What is this?" "How do you . . . ?" Mr. C. follows such an approach while working with the class as a whole or with an individual, his manner suggesting to the students that surely they know the answer. All problems are worked out on the blackboard, the class multiplying, dividing, or whatever, in unison. It's as though he decided that while the new math may give shape to the mathematics he teaches, he is committed to his students' mastering the four basic arithmetic processes. Loathe to discourage any student, he gives credit to students who give a wrong answer but seem to be on the right track.

When students have been assigned problems for the next day's class, Mr. C., in the time remaining, is on his feet until the bell rings. Like a bee darting from flower to flower, he moves from student to student as they announce their need for him by a raised hand. But he tells no one the answer nor exactly how he should proceed to obtain the answer. Rather, he asks, "OK, what is this?" or "Now, what should you look for here, the area or the circumference?" or "See, you've already got two-thirds of this right. Let's see what should be done next." His voice is always patient, warm, and supportive. As he moves about the room, the students either work alone or share their solutions with their neighbors.

Grade School Mathematics

Mrs. B.: Fourth Grade Teacher

"In math we have new books in the Macmillan series and we're basically following the order of the book. We've come to multiplication now, but the book assumes a background of multiplication that this group doesn't have. So I've arranged for the students to learn at their own rate. I told them they must rote memorize because they can't do complex problems otherwise. I use extra skills and games to help them master multiplication.

"Grades one and two have their own math series; it's very different. We only have our reading series in common with them. Grades three to six have the same math series; seventh and eighth may have, I don't know. The superintendent and principal hoped we would have uniform series for K-8, but it didn't work out. We had ten series to consider for math and we had meetings or workshops for about a total of three hours after each of us had personally examined the books and then made a selection. Grades one and two just did not want to adopt the Macmillan series, but their books are consumable so they can change them easily and frequently if they decide to do so.

"I have a feeling about math that I need to cover what they'll be getting to in the fifth grade. There's no particular relationship in social studies between the fourth and fifth grade. In science we do some of the same things because we both use E.S.S. materials. I've devised some of my own cards and Jane in the fifth grade will use the regular cards Even in math, if I don't cover all that I could, I tell Jane what we didn't get to. I talk with her a lot and tell her about the students as a group and where we got to, but I don't bother in social studies or science. In social studies we use the same series in grades four and five, but the books are delineated in such a way that the kids are not handicapped if I don't cover certain things. And in reading, the next grade's teacher just begins where I left off."

Mrs. B's Fourth Grade Math Class

The signs of a new unit are visible throughout the room. One bulletin board is titled "Metric Madness" and "Going Metric," and another reads "Explore Space," ready for the new science work. It contains posters of space ships, astronauts, and sky labs. Beneath the bulletin board is a long table of books, all on space, rockets, and planets.

The rest of the room displays other exhibits: stretched over the front black board are four horse-drawn stagecoaches with letters of the alphabet on them, student drawings of castles in a Halloween motif, a globe, about twenty library books on assorted subjects, four shelves of reference books, each student's name and birthday on a 3" X 5" piece of paper posted on a back wall bulletin board, a tree branch, without leaves, with poems hung from the limbs, a student job chart, an animal cage with two guinea pigs in it, and a variety of large and small plants either hanging from the ceiling, on the floor, or resting on a shelf near the window. The date on the front bulletin board reads, "October XIII, 1976."

Mrs. B. takes orders for the noon and second recess milk. White or chocolate. She asks how many brought their lunch. Everyone turns toward the flag to pledge allegiance.

T: *We will have a film this afternoon. These people will do the lights [she reads names], these the shades, these the screen, and these the projector. OK, if I'm gone, who would you prefer for a substitute?*

S: *Aunt Mary.*

S: *Mrs. McGill.*

T: *We've had no mothers volunteer for our Halloween party. If they want to, have 'em send a note.*

Mrs. B. calls the students' attention to the new bulletin board containing different lengths in the metric system. She holds up a meter stick and shows strips one decimeter, one millimeter, and one centimeter long.

T: Anybody know the temperature this morning?

S: 70° F.

T: How much was it when you got up?

S: 34° F.

T: How much Celsius?

[A student goes to the front of the room to look at a pair of thermometers to make a comparison between Celsius and Fahrenheit degrees.]

S: Can I check how much 70° F. is? It's 22° C.

S: 32 is exactly 0° Celsius [one student calls out without being asked].

T: OK, we have here on the table different things you'll need for your metric work. I've got a trundle wheel that measures in meters. Be careful with it. It's plastic and will break.

S: We counted 96 meters from one end of the hall to the other.

T: OK, there are beans, golf balls, and popsicle sticks.

S: What do we use for measuring millimeters?

T: You need to use your regular ruler. If you use a ruler, be sure to look at the right side of the ruler. Now, I've divided you into three groups--one has a set of cards, another has a different set of cards, and another has a booklet. Keep a record for your whole group. One person should do this. At the end of the day I want to see what you have done. So for the next couple of days you'll be in metric groups. We'll have metric game problems on Monday. Any questions about the group stuff? OK, get pens and paper. Remember you need a secretary for your group.

One group goes to the rug in the reading corner. They follow a sheet called "Metric Search" which tells them to find a shoe, button, crayon, paintbrush, key, penny, and paper clip. They enthusiastically search for these objects. One boy smells the shoe he has collected and pretends to faint. Another boy picks up a ruler and measures everything within reach. Soon they turn to their collected objects. They measure three objects before someone recalls they have to write down their results. Billy insists that it is time for a new person to be the measurer. He re-measures the penny and the quarter and comes up with different results from the first measurer. They argue until Billy concedes that the answer is not one and two centimeters, but two and three respectively.

They go to the next card of instructions. Susan reads instructions that require her group to draw a page full of airplanes, cars, or motorcycles. The boys press successfully for airplanes, even though the girls insist they can't draw one. Tim suggests they each draw one plane and he demonstrates two different kinds. He then continues drawing, to the amusement of the girls, one small, one fat, and one skinny plane. Meanwhile, one boy has been drawing a serious plane all this time. He shows the group his plane and Susan says he should draw a page full. He eagerly agrees.

They move to the next card which asks for line segments of different lengths in centimeters--one, three, four, five and seven. They call out the lengths they want to draw, debating over who called seven centimeters first, the preferred length, seemingly, because it is the longest. After drawing their lengths, students follow the card that directs them to make an imaginary picture using their already drawn lines. David prepares the picture, his group instructing him to draw a window, a flag, etc. They find the picture drawing amusing.

The next card calls for a "Smile Contest." They are instructed to measure smiles to the nearest millimeter and to offer an award to the student with the widest smile. They laugh as each of them pulls his mouth open, an index finger jammed into each corner, to the widest possible smile.

T: *Are you guys writing this down now? You're supposed to keep records.*

S: *I won the smile contest [Billy announces].*

T: *Wait a minute, people. I don't think you understand. You're supposed to write down each person's smile and its length. We'll be stopping soon, so don't start another card.*

S: *Where is my smile award?*

S: *It's one kiss from Jackie Brown.*

S: *Or you can eat my eraser.*

Mrs. T.'s Second Grade Math Class

Mrs. T. writes these numbers on the blackboard: 4, 5, 9

6, 2, 8

5, 5, 10

T: *OK, now, let's see. We have nineteen people here today. Let's kind of group up to have some teams.*

S: *Yeaa [they shout].*

T: *OK, what do you want your teams to be? What's a good Halloween name? Tim?*

S: *Jack O'Lantern.*

T: *OK. [She writes the team's name on the black board.] Diane's team, come over here on this side of the room.*

S: *We'll be the Ghosts.*

S: *Shucks.*

T: *Remember, we don't help. I'll give you the two addends and the sum and you give me the facts . . .*

S: *3 + 4 = 7. 7 - 4 = 2.*

S: *Nooo.*

T: *You can't give hints. I don't think we count that because Diane spoke up.*

Diane, you'll have to learn. You caused your team to lose. OK, Doug.

S: 5 + 2 = 7, 2 + 5 = 7.

S: Can't hear him.

T: Turn your TV up a bit. Don't help him. Can't wait too long. Now your subtraction. Shh, shh. Hands down people. C'mon Doug, can you do it? OK, no score yet. OK, Susan.

S: 5 + 2 = 7, 2 + 5 = 7, 7 - 2 = 5, 7 - 5 = 2.

T: Right. This is a score for the ghosts. [Students applaud.]

T: It's all yours, Brian.

S: 1 + 9 = 10, 9 + 1 = 10, 10 - 1 = 9, 1 - 10 = 9.

T: No hints. Let him think. No, remember with subtraction facts you begin with the sum. Tammy.

S: 3 + 2 = 5, 2 + 3 = 5, 5 - 3 = 2, 2 . . .

T: Somebody is whispering.

S: Two take away.

T: Your last subtraction fact.

S: 2 . . . 5 - 2 = 3.

S: She made it, didn't she?

T: That's a score for the Jack O'Lantern.

SOCIAL STUDIES IN BRT

Some form of social studies is taught in each year of BRT's four-year junior high school. In high school, however, students can graduate having had only one year of work in this area--the state-required U.S. history. This follows a year of U.S. history in the eighth grade which is not coordinated with the high school course. Coordination, if desired, could be difficult given the disposition of the junior high social studies teacher to emphasize those topics of strong personal interest.

As noted, high school social studies, unlike math and science, has not been taught by any one teacher long enough to establish it on a firm basis. This year, Mrs. F. teaches U.S. history and sociology. English is her major subject and she has not taught social studies, her minor, for five years. The sociology class presented below has the reputation of a catch-all for juniors and seniors merely looking for a course to take. The impact of this reputation and lack of continuity appears in the reactions of Bill, one of BRT's most able senior students: "My interest [in social studies] never got built up in the first place."

Throughout this section there are several references to the limited background and consequently narrow outlook of students in this rural community. By the time we reach the comment of Mrs. T., second grade teacher, it seems established as a general view of BRT's youth. She observes, in reference to her focus on understanding types of work, that, "Kids don't realize there are so many ways people earn a living." In short, the rural community, according to local teachers, provides a limited range of outlook and stimuli, and student awareness shows the impact of these limitations.

Mrs. F.: High School Social Studies Teacher

"All together I've taught seventeen years--nine years at a few different schools and eight years here at BRT. I'm in my ninth year now; of course, there was a ten year gap before coming back to teaching here when I was mother and housewife. During those years, I had it in mind to return eventually. I have three boys and I felt that I'd like to see them have a little better education. I knew if they did I'd probably have to contribute to the finances of the family. You know, it's a must, and it's a shame . . . sometimes I think, well, I enjoy my work. I don't feel like I have to work, I enjoy teaching, but so many people work because they have to.

"Now my sons are mostly grown up. Only one is at home and he's a high school senior at BRT. Still, we lead a busy life. We've always tried to maintain close family relationships; and between my family and my husband's, we've got nine brothers and sisters within easy driving distance. But I'm also an avid reader. When I wasn't teaching and before my children came along I could devour ten books a week, easy. I prefer something along the line of Gone With the Wind. Right now I belong to a book club and I've got a row of Reader's Digest condensed novels that I haven't been able to get to. We subscribe to several magazines, Reader's Digest and People, and to two Champaign newspapers. It seems like during the school year I'm so busy I never find the time to do things I want to do. I get up early enough to watch the morning CBS news and at night, well, I almost hate to say this . . . I read this article by Art Buchwald about President Ford's TV tastes, and I know it was tongue in cheek, but I guess I have the same interests--whodunits, situation comedies, that sort of thing--as President Ford. When I watch 'All in the Family', I either see myself or somebody I know. That's such a beautiful mirror, really. Otherwise, when I finish my work in the kitchen, I'll go sit down and watch what my son is watching. Of course, I have my circle group from the Methodist Church, but that only meets once a month. We're trying to get some men to join us, though it's still mostly women and the minister. We study different books of the Bible. Like next week I have to start preparing for a lesson on the Holy Spirit, which is rather a deep subject I'm not sure that I'm up to. The last one dealt with the Book of James. At any rate, this is something that I enjoy. I've tried different organizations, but I never felt like I took enough away from them to merit belonging. You know, in a small town we get involved in petty interests rather than in what I consider constructive. Meetings turn into gossip sessions. Many of the ladies will meet downtown everyday at ten or two the year round. I won't do that even during the summer when I could.

"Summer's a good time to catch up. I can do a lot of the reading I've been saving. Probably the first month I spend cleaning all the things I've let go. Then we try to take a little vacation. Nothing extravagant. And I'll spend time getting ready for school, if I know what I'm going to be doing. This past year I wasn't sure whether I'd be in English or social studies. Ordinarily I look for articles, bulletin board material, and this type of thing. I try to do some planning, though just at my leisure, really.

"I'll visit my mother a lot during the summer. She lives nearby. Just recently she's stopped working. Been making custom draperies for years. Dad was a tenant farmer and he died four years ago. We weren't rich by any means, but somehow my mom came up with the money and all of us got vocal, speech, music, or elocution lessons. Eventually, three of my sisters became teachers and I went to Illinois State to study speech and dramatics. Social studies was my minor. I had a high school teacher I was very fond of and hoped to emulate. She was in speech and I was involved in all the plays and speech and contest work.

"What a lonely year that first one at college was! I'd never been away from home before. I'm amused when I hear the kids around here say, 'The day I'm eighteen or the day after I graduate, man, I'm going to get out of here.' I probably felt the same way. I learned that these small towns are pretty good places when you're gone. I stayed at Illinois State till graduation and then came back home to look for a job. I was engaged when I graduated and my husband-to-be hadn't gone to college.

"I felt like I was prepared to teach when I graduated, especially after my practice teaching. That was the best part. I really wasn't interested in all the education courses I had to take because to me, they didn't sound practical. You'd learn things that were maybe good in theory, but when you got into the classroom, it was another ballgame, like in the area of discipline or motivation. I've heard other people remark, 'Well, so and so wrote this book but I bet they never taught five days.' I suppose, though, there are some basics that need to be taught. Still, when you're eighteen, nineteen, or twenty, you'd like something a little more exciting than philosophy of education. Now I see this as a necessary course; you have to have a base. Whatever it is we're going to do, we need a base for it.

"One summer I returned to school for a health education course. The school I was teaching at wanted me to prepare a curriculum in that area. Now if I were to return to school I think I'd like to study social problems, sociology, something in my minor field. I think there's a need to understand certain social problems like alcoholism in teenagers, drug problems, divorce. The idea of divorce still upsets me. I'm sure I'm a minority there. Premarital sex--this is completely foreign to me. My parents were very strict. How strict they were in the forties! Oh my goodness! I'm just not liberal thinking along that line. I fully believe in the sanctity of marriage. I'm not sure young poeple nowadays feel this way. It's incredible to me that a couple could be married and a young lady would choose not to take her husband's name. I've had students ask me before what I'd do if one of my sons had a mixed marriage. My response is, I think I would react this way, 'It's their choice.' I figure when they get to be that . . . These problems do not touch my family. At the same time, these things are happening; they're terrible, and you never know, they might come home.

"There are so many times that someone will come up with an idea that to me indicates they aren't thinking logically. This happens right in the classroom and I feel almost compelled to straighten them out. At the same time, it's difficult to do this without enforcing your own opinion on them. I really prefer an informal type classroom. If somebody comes in and they are really uptight about something they have seen or done, well, forget the assignment. If they are ready to discuss it, and I can see the interest, we may blow the whole period. It doesn't bother me to change my lesson plans. They may get more out of that than what I had planned anyway. The things that go on here on Saturday nights outside of school eventually get to school and sometimes you're forced to deal with them.

"My subjects, both English and history, are required and I probably wouldn't have a full classroom if they weren't. Anyway, I think I really have something to contribute to students. I have to keep reminding students why they have to take these subjects when they tell me they won't remember all this or that. No, they won't remember those things. So I usually say if you can take any assignment that I give you, do it to the best of your ability and complete it, then you have accomplished something. You're learning something about responsibility and about following directions. These are things you're going to have to do when you get out, going for a job, whatever. I'm sure that explanation falls on deaf ears sometimes, but that to me is what it amounts to.

"For example, in almost all my classes I require some kind of research paper. I give them a set of rules: you must use at least three references, you must keep note cards, you must meet deadlines. Following a given set of rules--it's hard to believe that students don't realize the importance of that kind of thing. This is one of the things, aside from the subject matter, that I try to do. I've always tried to be very careful not to make my subject matter appear to be more important than what they're taking in any other class. This is unfair to students. I've taught with teachers whose requirements for students were above and beyond what they should be.

"I think we all have to keep to the basics. So far as I'm concerned, it's essential that students have some general knowledge about their background. Thus, history, you see. But I don't believe in committing to memory dates and places, things that we cannot show are relevant. If they can catch the general idea of what the country was like in a particular period . . . It's enough if they can say this is the way things were and these are some of the reasons for it. Then they should be able to relate those things. What I'm trying to do is bring the past up to the present, I guess. It's a matter of seeing relationships because facts aren't anything by themselves. Too often they learn something for the moment with no carryover to it. I suppose this is part of what I mean when I say 'See the relationships,' seeing something relevant to tomorrow's assignment and what we had two weeks ago. There's a thread. It's almost like the plot of a novel running through all this. Yet, so many of them, what they learn is for a test.

"I don't think I resist change if it can be shown to me to be of value. I'm not different from anybody else. Sometimes it's just inconvenient as the devil to change. It all depends on what you're accustomed to. I don't think the parents are urging us one way or the other. I seldom ever talk to parents unless I've sent home a failing notice. We don't have a parent-teacher organization. My husband's a mechanic and sometimes he gets in a young man and he'll comment that we need to teach these kids how to read directions. But our communication with parents is extremely low. Either they're quite satisfied or they don't know what's happening. I don't believe I teach in response to any particular way I think the community feels. Still, still I live in the community. That's different from people who drive in everyday. I know how parents feel toward the school. They're proud of it. One day a boy came to class with a copy of Catcher in the Rye saying he wanted us to study it. I hadn't read it so I secured a copy, read it, and said no to using it in class. I said there has to be something better to study. I realize this book is supposed to be some kind of psychological study in the maturation of the boy, but somehow I would not have been comfortable with it. And I don't think some of the parents, if they were to pick up the book at home, would have appreciated my using it. I found the language offensive. I told the class that whatever I bring into the class for study has to be what I consider good literature. But parents have never called to complain. If our discussion of capital punishment didn't do it and abortion didn't do it . . .

"Right now students are only required to take U.S. history in the social studies area. We're so downed by schedules it would be idealistic to think there's room for another required course in this area. But if I could require one course, it'd be sociology. If it's well taught, if it's well received, some of biggest problems are there--crime, war, delinquency, the social problems. And a study of those social problems might stimulate some of these people into social service. And to me that's where it's at. I know there's always been problems, but I'm a confounded optimist.

"Our students have to think in terms of a world a little larger than this community, so far as problems are concerned. We had this film the other day in sociology, Black and White Uptight. A good film on the race issue. The class didn't want to discuss it. I could see them shrinking--'Oh no, not that again.' I said, 'Well, I have only one comment to make. I want you to consider how well you would survive if you had to walk in that Negro's shoes for one day.' The film showed the mother not having milk for her babies, only sugar water, the rats, the hanging plaster. And to the students . . . I can understand the opinions they've gotten at home. They're simply repeating things they've heard. I don't know. The sociology class has twelve students, most of them seniors. Mostly, they're slow students. They were looking for a course with a minimum amount of work. They're not interested in facts. They have opinions but won't go to the trouble to back them up with research. The one thing they're looking forward to is graduation. Makes you wonder about compulsory education. I'm from the old school--you must have a good education if you want to get anywhere. I don't know about this when we have kids here whose achievement level is in the seventh grade and we require them to come and sit in school five more years. When you see them in your classroom you wish that rather than force them to come here and sit day after day and sleep, too bad you can't do something else for them. Some of the seniors look forward to only one thing and that's graduating in May.

"At any rate, here's what I'm trying to get across in the sociology class. First of all, that you, the student, you're a member of the group. You have a responsibility to the group and you should never consider that your contributions toward class discussion, toward group activities, is not important. I'm trying to get them to see the fact that they are part of the whole and what they do affects someone else.

"Now this week I have three days of discussion set up. I was loused up one day because the seniors were gone all day and when I made out my plans I didn't know this. I gave them an assignment to interview three people as to what they consider the merits or disadvantages of Little League baseball and Pee Wee football in regard to youngsters of that age being involved in competitive sports. Then another day I want to take up with them this idea of cooperation in a dictatorship as compared to competition in a democracy and then branch out into how the individual is affected by the group and vice versa. Whether or not they'll do these assignments, I have no idea. I'd say that probably three or four will maybe take the trouble to interview someone.

"Another idea that I'm doing is competition in American students scholastically and athletically, whether it's good or bad, what kind of problems does it create. I'm interested in seeing what they'll do with this question of dangers and rivalry between nations, which is all a part of the competitive area. And whether or not they'll be willing to discuss the idea of nuclear arms race or if they're aware of what the results of competition in this area could mean--catastrophe for all of us.

"So I'm concerned with the individual's place in a group and with competition. I feel I have to relate them to something they're familiar with. That's how I come to Little League and school events.

"You know, I kind of get the feeling that this tune of anti-establishment is still with us, though maybe not so much as a few years ago. Students just aren't too sure that we oldsters have much to contribute to them, that we don't understand them. The one thing that is probably nearest and dearest to their hearts is working. We don't just release them from school for work. They must notify the school ahead of time, have their parents' permission, and get the assignment and make up the work prior to their being gone. This is new and many of them resent this. Always before if daddy was ready to pick corn they'd stay home for three days and then come back and pick up where they left off. And I've heard different ones say, 'Why can't we graduate in the middle of the year like they do in big schools? Then we could get out and get a job before the summer when everything else is taken.' Well, I never did feel like emotionally they were ready, they were mature enough. I can't imagine them at seventeen or eighteen out on the job market. So this is one thing we've discussed. Why did we change the rules? Is it just another old rule? So this is why I feel they're kind of down on the establishment. I hope that by the time they finish they'll understand that society is built on some kind of rules and regulations and they're there for the purpose to protect you, not to antagonize you.

"But this is one area I think kids have changed since I began teaching. Back in the fifties they would not question a rule. Now they question every rule. Young people do not respect authority as they used to. They question why is this necessary; perhaps they question many more things. A good example of this is the draft. Look at our evaders and deserters that we're still fussing about now. 'Why?' 'You can't force me to do it.' It's almost as though we have to prove why we're here, why we're functioning. 'What makes you think you have anything of value to teach us?' You know, I get the feeling many times that I'm on the defensive as a teacher. It isn't enough that I stand up and say, 'This is your assignment.' I almost feel as though I have to prove it, to prove that there's value in doing it, other than the fact that I just want them to do it.

"Sometimes they really surprise me. I expect to get a spark from a particular topic and I strike out. The other day when we were discussing collective behavior I thought I'd get some interest in Adolph Hitler because the book discusses how he used a knowledge of collective behavior to get what he wanted. I expected more questions, more interest. Hitler is removed from them and yet not so far. Patton was on TV the other night.

"Another thing is I think they're less competitive scholastically than they were even three or four years ago. Students don't seem to mind if they're not on the honor roll. And I don't know how much parents mind either. There's the idea, 'Why should I go to college, spend all that money and time, and maybe not find a job?' Gee whiz, there's a lot of teachers out here without jobs. A year or so ago there were all those engineers laid off. They're selling hamburgers or something. Students say they can go out and lay bricks for eight or nine dollars an hour, so why should I go to school. Whenever I say anything in class about getting your diploma, somebody's always ready with an exception to the rule. They know a guy who's making X thousands a year and of course didn't graduate.

"One thing that hasn't changed is grades--students don't like to get them and I don't like to give them. I don't brood over them but neither do I feel that I can just follow test scores. So I probably spend more time on grades than maybe other teachers do. I don't want to over- or under-evaluate. There's so many things we don't know in regard to the background of a child. The emotional level of the family, what things are like at home, what kinds of responsibilities . . . As far as I'm concerned these things affect the child. One boy slept all the way through class the other day. I don't know if he didn't feel well or not. Now this is frustrating to me. And yet so many things I find it better to ignore. We'll see if he sleeps on Monday. If he does, I'm in trouble.

"At any rate, I like kids. I like the give and take between students. I enjoy observing them in the halls between classes. And if you're in a place more than four years you can see them grow physically, mentally, and socially. I get a lot of satisfaction out of teaching or I wouldn't be here. For maybe ten years more I'd like to teach and then do other things. Maybe travel, or just sit around."

High School Social Studies Classes

U.S. History

On the blackboard, Mrs. F. has written: "Amnesty in 1863 and 1968-76 and voting qualifications for blacks in 1863 and the poor qualifications of minority voters today."

T: How many of you favor full pardon for those who went to Canada to avoid being drafted at the time of the Vietnam War? [No hands are raised to answer the question.]

S: What happens if we don't give them a full pardon?

T: I'm not sure, Marie, what would happen if they decided to come home. Maybe they'd be jailed or have to follow a rehabilitation program. My reason for asking is I hoped to find someone who felt strongly about their return. I hoped to come up with a good debate. Now, are any of you willing to take that viewpoint? [Students talk to each other but nobody appears willing to do so.] I'm not so well-versed on this topic. Marie, willyou do a little research for me? What does President Ford believe about this? [Marie agrees to do this investigation. The boys in class seem to be agitated.] If any of you were of an age to face the decision of Vietnam maybe you'd feel different than you feel now. [The class is silent.] Marie, have it ready for Monday, please. Hopefully, some of our films will be in Friday or Monday.

U.S. History

A film is to be shown during this period. Mrs. F. opens the class with a long introduction that suggests the Civil War is not over yet. She tries to connect yesterday's reading about the post-Civil War period and today's film. The film is about busing primary-school-aged blacks to a white school and parental reactions to busing.

When the film is over, Mrs. F. asks, "What do you think about the film and the issues?" There is a long silence in response. Finally, one boy says, "The film was OK." Then Randy, a newcomer to the school district who attended an integrated school before moving to BRT, describes his previous school. "We had thirty percent blacks in the school but I'd say only two percent mixed with the whites. We had near riots a couple of times. There were black tables in the lunchroom. They did their thing and we did ours." Again, the students respond with silence.

Mrs. F. comments, "I was amazed at the ignorance of the adults in that film. They had such poor manners and no social graces. I don't expect to see the problem solved in my day, but some of you might live elsewhere, not in BRT all your life, and you'll have to understand and make decisions about these issues." As the period ends, Mrs. F. passes out homework papers and reminds the class about their exam tomorrow. Randy is taunted by some joking questions about his former high school.

After class, Mrs. F. says that her students lead such sheltered lives. "Many will graduate and go live on farms out there." She points to the fields that surround the school. "I get so frustrated at times trying to reach them. They seem so disinterested. Maybe they feel more than they let on."

Sociology

Mrs. F. begins reading from the textbook. The topic is explanations of cultural variability. Harry reads next. The other students sit quietly and follow along with the reader.

S: *Is that far enough?*

T: *Please continue. . . . OK, this tells us that geographic factors do not explain cultural variations because we find different cultures in the same geographic area. . . . [A student asks a question about some point in the text.]*

T: *I don't know. Why don't you look that up?*

T: *Jill, will you read?*

S: *I can't.*

T: *Sure you can. Try.*

S: *I know I can't, so why should I try?*

T: *Sure you can, Jill. [Jill reads and does quite well.] Thank you, Jill. So it has a contributing effect, but does not explain the whole thing. Are cultural variations a product of race? Patty, would you like to read? [Patty reads.] So we cannot rely on race as an explanation for why cultures vary. And geography's not the answer. All right. Let's see what follows. Ed, will you read? [He reads.] Tim, please read.*

Tim asks Mrs. F. why in yesterday's class she compared Australian aborigines with bones in their lips and Americans chewing gum. She explains that using bones is what Australians do and chewing gum is what we do. Tim stops reading after he is too frequently corrected by the boys on either side of him. "I don't feel like reading no more," he says.

T: *So we didn't find a specific explanation. Elements of chance are to be included along with geography, race, etc. OK, a question for you. What effect has geography had on development of culture in your region of the U.S.? OK, what do we need to consider to answer that?*

S: *Surroundings?*

T: *Including . . .*

S: *Food, water, climate.*

T: *OK*

S: Uhh, the way the ground is. No mountains, things like that.

T: Now in what way have all these things affected what we do here?

S: I don't know. That we farm. [Harry says diffidently.]

T: Yes, this is a farming region. What I'd like for you to do is try to determine in the village of Rhodes which businesses are farm-related. It's interesting to find out how many people are in businesses other than ag-related ones. Think of your neighbors.

S: They're retired.

T: We have people who drive to Champaign-Urbana and Rantoul. Do a little checking on your own for me, OK. Geography can exert only a limiting effect on cultural development. I think we'll carry on here. David, would you read?

Sociology

T: We're going to have a test on Tuesday. You'll need to study very hard for it. All the terms in the chapter will be on the test. You should know something about them from class. [There is much student talking. Some of it is boisterous. Mrs. F. remains perfectly calm.] Leaf through chapters three, four, and five. See if you have any questions. This will amount to a unit test. Our next unit is on the group and the individual. I plan to hand out another text and we'll use two of them together. We'll find examples in one not in the other. It'll be of great interest to you.

S: Do we need to know all the words? There's about a hundred of them.

T: Part of your problem may be you're not attentive in class.

S: How're we supposed to memorize fifty definitions?

T: It'll be an objective test so you'll be able to use recognition. OK, I had the librarian bring us books from the library in hopes you'll find something for your research project. For example, the Japanese in the United States. Also books on Negroes, on protest, and man versus society. There's been a lot of this in recent years. Why the protest? Do people gain what they're hoping to get? We've got books on crime, overpopulation, Jews, Puerto Ricans, dignity in death. So I want you to think in terms of possible topics. You can use these books, but only in this room. (All the students are quiet, listening to Mrs. F.) The first half of the quarter is over and we'll do these projects next. Today I'll change the plans a little and not get into the new chapter. You can study, since it's Friday, and you can go through the books I have up here. . . . How many heard the Ford-Carter debates last night?

S: I watched 'em come on and go off and slept during the rest.

S: Boring.

S: The best part is when the sound went off.

T: Don't you think there's much to be said for enlightened citizenry?

S: I don't want to know that bad.

T: I was impressed with both their presentations. From what I'd heard, if I hadn't made up my mind, I wouldn't have been able to decide after last night. Both did well.

S: By the time it was over, Carter was hurting pretty bad.

T: You think so?

S: Carter's got that smile. I like him better than Ford by a long shot.

Mrs. R. does not respond to this observation. She walks over to a student to help him select a book. There are five boys sitting at the back of the room, somewhat apart from other students, engaged in increasingly animated discussion.

S: Blacks are afraid unless they're in groups of three. One alone'll never fight. Jigs are a bunch of bums, anyway. Hate 'em all. I never saw one I liked.

S: You're a racist.

S: So am I and there's nothing wrong with it.

S: Yeah, nothing wrong with it.

S: They're stupid.

S: No, they're not.

S: Let 'em go right back to the jungle.

S: They sit back and collect all that welfare.

S: I think you ought to shut up.

T: I don't mind if you discuss something current if you use logic. This is not constructive.

S: We keep 'em alive.

S: They got the worst end of the deal. The rip off.

S: Yeah, they collect food stamps and drive Cadillacs.

S: They shouldn't get to go to school free. That's why there's so many black athletes now.

T: I don't think you're getting anywhere.

S: I never saw one with a good education.

S: We drove 'em from it.

T: I think a debate would be fine but we need to establish some rules. OK, we'll set one up. If we have a debate, you'll need to do research. Get some facts. Not just your opinions.

S: We went to town the other day and heard this old black bum complaining about her welfare check.

T: Maybe she had obligations.

S: If it was a white person, he'd take care of the thing himself.

S: She'll just go home and sit in front of her color TV.

T: Tim, we'll close this discussion now.

S: Can we have a panel discussion among us four?

S: I want a boxing match.

T: Tim, consider it closed till we get guidelines. We can't start on Monday 'cause we've got other things to do.

S: I'm ready right now.

Mrs. F. goes to another part of the room to continue helping students select a book. The boys at the back of the room continue their verbal sparring.

Sociology students are tested regularly. Their first test of the semester appears as Appendix E. It includes the mixture of objective and subjective test items that Mrs. F.'s tests usually contain. She always includes several essay questions, though many students will respond not so much with an essay as with several lines.

High School Students' Views of Social Studies

Steve: A Junior

"U.S. History, it's about events that happen in the past, people doing things that we're still doing the same things today. All we're talking about now is industrialism, the big industrialists. Back then they paid people little, fired you at the spur of the moment, and you worked long hours. Now it's better. You can talk to the boss and you don't get fired without speaking your piece first.

"We studied immigration, how people like the Chinese, etc., came over here and took jobs for less money. They also used child labor. I didn't like immigration; those people shouldn't have been able to come. They took out jobs. If they did not get jobs, the immigrants went to live in slums. I got this idea about immigration from the text because those people did not stay at home to settle their problems.

"In history we read, see films, get notes from the teacher, talk and take tests or quizzes. I'd like to see more films. We saw Jazz Age, but it was not on the subject we were on at the time. The book was better than a film in this case, but people pay more attention to films. Lectures get boring. Films have some funny parts and the class is funny only when students make jokes. We learn more from films. It's not over our heads like some of the language the teacher uses.

"When we have discussion, the teacher is wanting to find out if we read the chapter and looked up the words in bold face print. Those usually are on tests. Also if we understood what we read and can recall the facts. Our books are open when we do this. She always asks questions from the back of the chapter and some from the top of her head. And she'll ask our opinions, like what we thought of immigrants or the Pullman strike. We also have essays to write on tests, but essays are worth not more than ten points out of one hundred total. You don't have to go to no great deal on the essay. It just takes about a paragraph to sum up what needs to be said.

"What I liked best last semester in history was the voting, the mock election. We had to really work together. We got experience to know how to vote. It was fun. For electing class officers, you just raise your hand, but the presidential elections took the whole day. We all participated, not just one person doing it. In anything else in history, just one or two people are always answering the questions. Here, we all helped.

"In class, we read what we're supposed to, at least occasionally. Nobody does too much in history because most think it's boring. You go through the same routine. When the teacher asks how many read the lesson, only one or two raise their hands.

"We thought the section on the gold rush was interesting so most students read it. I read that chapter. It was interesting because people went so crazy to get the gold. That was dumb; they should have shared.

"Before a test, I look into the chapter, flick through the headings. You have to read the class notes because you couldn't pass the tests otherwise.

"What I'd like to see in class is debates, because people got different points. We ought to get practice tests before the real tests so we'd get more involved. Current events in class would be a good thing, too. Divide up into teams and use a newspaper that has questions we could answer, like one-pointers or two-pointers. We got more out of history in junior high. We all read the paper and watched the news all the time. Now we only read the sports. In junior high we chose up teams at the beginning of the year and the winners drank pop. The teacher always showed us the other side of things, like if the immigrants didn't come here what would have happened. And everybody read All Quiet on the Western Front. We all paid more attention in junior high in everything. Things have changed now. Teachers just want to get rid of you to get you through high school. They figure you know when you don't know. We all participated back then. Now we've lost contact with teachers. Maybe it's a generation gap."

Tammy: A Junior

"Next year I'll take sociology and psychology. I need them because they're useful for being a psychiatric nurse. Any course I take is for my own personal interest or for college. In U.S. history this year we're studying about the changing course of our country. That's what U.S. history is about. About people. It's the same for any history--the way a country is and how it grows, the patterns of society, the way it integrates with the world, how different groups come together to make a nation (like the melting pot in the U.S.), and how a nation needs to change to fit into a changing world. It's a useful course because we learn more about people, why they behave the way they do. For example, learning about the persecution of blacks--this helped me to understand blacks today.

Bill: A Senior

"Ever since I entered high school, I always had a full schedule. No free periods. This year I'm taking two sciences. Took industrial arts last year. Never considered taking sociology or psychology. I don't know, it concerns your everyday life, but I never placed too much emphasis on it. When classes I thought were more important became available, I never gave the others a thought. My interest [in social studies] never got built up in the first place. Of course, I had to take U.S. history. I had a bad teacher [Mrs. F.'s predecessor]. He's gone now. The class was a rehash of junior high stuff. It was just something I had to take.

"In the past year or two I've heard talk about consolidation around home. It is a definite possibility with enrollment going down. My family is strongly against it. Students talk about it quite a bit. We're privileged to have a school like this. We think of ourself as the cream of the crop around here. It's a pretty good school. It's the cleanest and most orderly. I like a school that's small and nice, without destruction. There are advantages to a small school. Small classes mean teachers can put more emphasis on learning and learning right. Here teachers can afford to make sure you're getting it, especially in chemistry, physics, and math. It's no problem to see a teacher to get help. We only touch on trig and calculus in senior math, but maybe it's better to touch on it and get it, than to take a whole class on the subject at a larger school. Sure, everything's not perfect. Probably U.S. history is the worst class I ever took. I learned something, but I didn't enjoy it. He mispronounced words; that was a standing joke in our class. He lectured for the first nine weeks right from the book, and he acted like he hadn't heard about the things he was teaching about."

Junior High Social Studies -
Mr. J.: Social Studies Teacher and Junior High Principal

"Here in the junior high we teach geography of the U.S. in the fifth grade. Then it's Latin America and Canada in the sixth grade, the western hemisphere minus the U.S. We use an outdated book for this, good on geography, but poor on current events. Seventh graders study world history. The urban revolution is the theme of the book. Kids don't seem to appreciate world history. And we finish off with U.S. history, which is what I teach.

"I don't know how Mrs. F. over at the high school does it, if she teaches pre-or-post 1865, but I don't get past World War I. I don't really follow the book. We go right past the colonial period, skipping the first two hundred pages. However, we do spend about two months on the Constitution. This is important; if you learn to play a game, you have to learn the rules. The Constitution fascinates me, especially since the school law course I studied recently. I bring in case studies on constitutional law and also recent ones like the Tinker case in Des Moines.

"What I try to do in this course is to get 'em to think a little. That's the hardest thing. We don't do a whole lot with memorization. Now in the first half of the course I emphasize the build-up to the Civil War. 'Keep this in mind all the time,' I say to the class. Then about one and a half weeks on manifest destiny--what it is and was it right. I ask them to put themselves in place of people and think how they'd feel if they were run off their land. Kids relate to the Civil War. They don't understand slavery. There's a hell of a lot of prejudice around here. Students read how slavery is a good thing in one handout and then in another they read a Southern industrialist saying it's bad for the economy.

"The kids are more open than their parents. I think they're more open than they were six years ago when I came here. Kids have to learn to understand why they believe what they believe and also how their beliefs are a reflection of their parents. I've been criticized by parents and also by a board member who thought I was criticizing Catholics. Once I asked a kid to explain the confessional. His father was furious with me.

"There's a few major points I try to emphasize whatever we're discussing. First is that if you understand what came before, then you'll understand what's happening today. Second is to be open-minded, about different people, religious, and political systems. I also got into hot water on that. I've been accused of being a communist and an atheist. Once the science teacher and I brought our two classes together to discuss Darwin. We were studying the twenties in history and talking about the Scopes trial. A few periods later a kid came by and asked if I was an atheist. These students are riled by a discussion of evolution. There's many fundamentalist Christians around here. Kids asked us if we personally believe in the theory and we had to say yes. They don't understand that Darwin was still a Christian even after developing his theories. Recently people from the Gideon Society camein to make a presentation of little Bibles. They got permission from the Board. This isn't right. What about the rights of the minority? Anyways, another thing I emphasize is an understanding of freedom and responsibility. The two go hand in hand. Freedom is always qualified; nobody's got it complete and total. Personally, my own philosophy is very conservative, especially about the expansion of money. I never could understand Keynes. I think both people and governments should live within their means. The last thing I push at 'em is the human aspect of war. Today kids seem to be getting back to the bang-bang stuff like when I was a kid. They were playing a shooting game at recess yesterday. In history we'll spend two weeks on All Quiet on the Western Front. At one particular point in the novel I've shot off a starting gun for dramatic effect. I've always hated war myself. I was drafted but never went to Vietnam and kids now don't even know about Vietnam. My ideas were shaped in the late sixties."

Grade School Social Studies –
Mrs. B.: Fourth Grade Teacher

"Rural kids have a different experiential background. A fourth grader here is like a third grader in Champaign. They are not aware of places and differences in people,in culture that even a small city like Champaign has access to. All kids here have had very similar experiences and have the same way of thinking through things. Even in regard to kids' experiences with older kids--they're with the same kids from kindergarten on up. This is a limitation of rural schools. The students are not used to differences of opinion and different kids. It takes a new kid a longer time to get accepted. Here it is safe and not so worldly.

"For me, social studies is of middle level importance. Reading and math are ahead, but science is behind it because I'm not as good in science as in social studies where I do lots of map work. Kids have no concept of where places are. We have a text, but I haven't used it yet. The name of the text is Exploring Regions from Folletts. I also emphasize how to read maps. My husband is making tapes on little known countries like Andorra and Monaco. He also helped me prepare the map units. This year I'm working on interests, what interests the kids. For example, deserts--what they are interested in knowing, the animals, the location, etc. They can work on things of interest which they list, I list, the book lists. They'll work in groups and singly do a research topic. They'll make things--animals, deserts, etc. They like making things, but I also want to develop their research skills so they give oral reports. During the recent space unit, students asked very good questions, and if the group did not know the answers, they were very willing to locate them.

"One unit in our social studies book is on government and we'll probably hold an election and organize ourselves as a legislature to make laws. We did this last year and it went well. I was the president and had a veto. They made laws about free time, organizing a party, etc. After space, I went to a unit on light based on the text. The students are fighting the idea of the whole-class-as-a-group thing. They liked the space unit very much and are rejecting the way we study light, the whole class all together.

They like hands-on activity. They like to learn for themselves. I don't like the whole group thing either. When we get to sound and the water cycle I'll find out what they want to know and also use E.S.S. kits. I want to try learning centers, for example, with sound. All will have to do it at some time and those more interested can do more. I tried the idea in English and the students loved it, though it wasn't too flexible because it was skill and not theme-oriented like science learning center would be. We'll try learning centers in social studies, too, but I'm not ready yet."

Mrs. B.'s Fourth Grade Social Studies Class

Mrs. B. instructs her students to leave their groups and return to their own seats. She collects the records each group has kept. "OK," she says, "now you've got to switch gears." Several students make a gear switching noise.

T: Table two is ready. Robert's ready. Everybody's ready. OK, switch from measurement to talking about the globe. [She holds up a globe.] This thing around the center of the earth is the equator. Is it really there?

S: No.

T: What does it split the earth into?

S: Hemispheres.

T: Which one are we in?

S: The western and northern both.

T: [Mrs. B. leaves her desk to pull down some maps.] If you can't see, come and switch your chairs to the front. The maps here show the eastern and western hemisphere. Here's the equator. Right? OK, here is Antarctica. What hemisphere is Antarctica in?

S: South.

T: Yes, because it's below the equator. Another one?

S: Eastern.

S: Western.

T: Can everybody see the Indian Ocean? Who can tell me what hemisphere it's in?

S: Southern.

T: Yes, because it's below the equator. One more.

S: Eastern.

T: Is it above the equator?

S: Yes.

T: Yes, a little bit; just a smidge. Let's check out Africa. What hemisphere is it in? Jim.

S: Northern and southern and eastern.

T: *Yes, because it's above and below the equator.*

T: *What ocean is in all four hemispheres?*

S: *Pacific.*

T: *Another one?*

S: *Atlantic.*

T: *I think you've got this down well. There's a couple of questions on the worksheet about hemispheres. If the question is "N.A. is blank of S.A.," start with the second one. Remember. Save yourself a hassle. Do it the easy way. Start with the second one. If I said, "Africa is blank of Australia . . ."*

S: *South.*

S: *Ohhhhh.*

S: *Good grief!*

S: *Run that one by again.*

T: *[Mrs. B. explains the point again and then continues.] If you're facing the map, up is north, down is south, and your right hand is . . . east. Right. And your left hand is . . . west. [Students return to their desks amidst a hubbub of pencil sharpening, chair scraping, and desk rummaging.] If you're done before P.E., you have fifteen minutes to find something quiet to do. Turn your worksheet in first. People, I think the maps on the top of your page will help you more than anything else. [She says this in reaction to the scurrying around the room for globes and atlases. Many students go to Mrs. B. for help. She offers it willingly and patiently, reexplaining often what she had explained in her general presentation.] If you're not done, stick it in your desk and finish it after lunch. Get ready for P.E.*

T: *From your list of three choices I made up a list of people who will work on the different topics. Sometimes there's only one person on a topic. You might not want to work alone. I tried to give you your number one choice, but there's no more than three in a group. If you want to switch, this is your chance now.*

S: *I'm on Mars. Can I change?*

T: *Yes, if you want to. If you're satisfied with the group you're on, pass the list on to the next person.*

Students come to the rear table full of space books. A pair of girls get one book and go to the reading corner. Two boys come to find references on Cape Canaveral. Soon, the students are clustered in a tight knot at the table, searching for books that fit their topic. Two boys and a girl talk about who likes whom. The girl says she'll tell Tracy. Several boys wrestle over the use of the unabridged dictionary. Others play with halloween decorations and a little car. One group of three students, books in hand, wander a bit until they find what they feel is a comfortable place to settle down.

One group is investigating Cape Canaveral. Eric browses in an unabridged dictionary. Cindy looks at pictures in a reference book. She turns to one of a rainbow and says, "David, do you know if you walked toward a rainbow you could never touch it. It just looks like it touches the ground." David asks no one in particular, "You guys find anything yet?" I'll look in this World Book." Eric comes across the word "cobra" in the dictionary.

"Wow! Look at that. Six feet long." He tells Cindy not to copy down what she finds in her dictionary because it's the same as in his. As they determine that a book contains nothing of value to them, they return it to the main table, their initial large stock of carefully hoarded books slowly vanishing. Over a period of twenty-five minutes, the group's attention is fully focused on their sources, though not necessarily on Cape Canaveral. They speak frequently about not forgetting to take notes, but at most write only a few lines.

Mrs. B. ends this session as she announces, "People, in three minutes we go to lunch." Books are returned to the table and students line up in pairs, two girls waiting for Mrs. B's signal to leave with their shoe laces tied together.

The day after the above lesson Mrs. B. distributed the following outline of work in language arts which will accompany the class' social study work on space.

(Fourth Grade Unit Work on Spaceships and Explorers)

Space Monkey
_____go over new words with me, read story
_____worksheet
_____self-help 37, 38
_____workbook 50,51,52,53
_____conference with me

Three Skies
_____Read poem. What do you think the poet means?
_____Think about the colors you have seen in the sky--during the day, before a storm, at sunrise, sunset, at night. Draw a picture on a small sheet of paper which shows a sky . . .

America's First Astronauts
_____go over new words with me. Read part I, pp. 148-158
_____pretend you were writing about Alan Shepard's flight for a newspaper.
_____Tell about it in 3-5 sentences (or more). Include who, what, when, where, why, and how. Try to make it interesting but include necessary details . . .

Flight Song
_____read poem to yourself
_____get in a group of three people, to read it as a choral reading (one person reads the first stanza, another reads the second stanza, and another the third stanza. Then you all read the fourth stanza together.) Read it to me after you have practices . . .

End-of-unit
_____do p. 83 in book
_____on p. 184, pick one of the mini-stories and write several paragraphs about it
_____self-help p. 45-46
_____workbook p. 66, 67, 68
_____group contest
_____evaluate unit

Mrs. T.: Second Grade Teacher

"I feel the same about social studies as I do about science. I don't see it as a subject for which there's a need for evaluation or a formal textbook. Second graders need the beginning of map skills. Kids today are conscious of places. We contrast rural and urban living, but don't do much with government. This year we participated in the mock election. We identified the candidates, not the issues. We used ballots from our Weekly Reader with pictures on them. The results here followed community and area results--pro-Ford, but not strongly. From time to time I encourage them to become aware of the news on TV and we talk about it. Each week we get our Weekly Reader and discuss the stories, look at the pictures. Each morning we have a discussion time, but they talk more about personal and family topics. I ask open-ended questions.

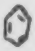
"As social situations occur in any of our reading material, they're used for discussion. For example, there's a story on Washington, D. C. and what some group of kids are seeing there. I get out my maps and we locate the Capitol, Washington Monument, etc. I'll bring in my own books on the White House and they'll do picture looking. I'll also bring books from the library so kids learn there's different sources of information.

"There's a few big things I try to get across under social studies. First, an introduction to map skills. Second, to get a feeling of their own family unit as part of the bigger community. Third, to talk about people in positions of authority in the school and family. And fourth, to understand types of work, ways of earning a living. Kids don't realize there are so many ways people earn a living."

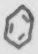
APPENDIX A - STUDY GUIDE AND TEST FOR CHEMISTRY II

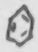
Chemistry II Chapter 17 Study Guide

23. What does the suffix -diene indicate?
24. What is the structural formula for butadiene? How is it prepared? What is it used for?
25. Write the 2 resonance structures for benzene.
26. What is the name and structure for the C_6H_5 group?
27. How is benzene obtained? What are some of its uses?
28. Complete the following equations. Write names for all products.

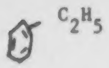
a)  + $Br_2 \xrightarrow{Fe}$

b) + $HNO_3 \xrightarrow{H_2SO_4}$

c)  + $H_2SO_4 \xrightarrow{SO_3}$

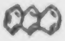
d)  + $CH_3Cl \xrightarrow{AlCl_3}$

e) + $C_2H_4 \xrightarrow[HCl]{AlCl_3}$

f) 

$\xrightarrow[650^\circ]{catalyst}$

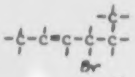
What is the product of f) used for?

29. What is the name for ?  ?
30. How is natural rubber produced?
31. Why is sulfur added to rubber?
32. What is vulcanization? Describe what happens during this process.
33. How is neoprene produced? What is its advantage?
34. How is SBR produced? Why is it used in tires?
35. How is buryl rubber produced? What is its advantage?
36. How is nitrile rubber produced? What is its advantage?
37. Draw structural formulas for each of the following compounds.

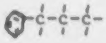
a) 2-pentyne
b) 1,1,2,2-tetrabromoethane
c) nitrobenzene
d) ethyl benzene
e) 2,3,6-trifluoro-1-heptene
f) 3,4 decadiene

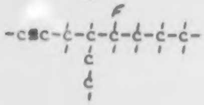
38. Name each of the following compounds.

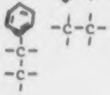
a)

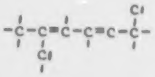


b)



c) 

d) 

e) 

Chemistry II Test on Chapter 17

Part I: Answer each of the following questions completely and carefully.

1. Explain why a student should not perform any experiment with organic compounds without detailed laboratory instructions and then only with the supervision of an instructor. (5 pts)
2. Write the structural formulas for 5 of the isomers of C_5H_{12}. Name each of the isomers. (15 pts)

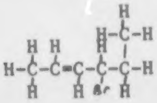
3. Write the empirical formulas for the compound consisting of 12 carbon atoms if (3 pts each)
   a. alkane
   b. alkene
   c. alkyne
4. Define each of the following. (4 pts each)
   a. dimerization:
   b. fractional distillation:
   c. cracking:
   d. vinyl group:-extra credit
   e. alkadiene:
   f. aromatic:
   g. halogen:
   h. vulcanization:

Part II: Draw structural formulas for each of the following compounds. (5 pts each)

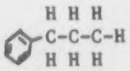
1. 2-pentyne
2. 1,1,2,2, tetrabromeoethane
3. nitrobenzene
4. ethyl benzene
5. 2,3,6, trifluoro-1-heptene
6. 3,4, decadiene

Part III: Name each of the following compounds. (5 pts each)

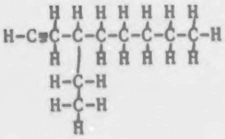
1.



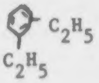
2.



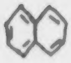
3.



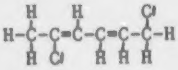
4.



5.



6.



$$\text{H}-\underset{\text{H}}{\overset{\text{H}}{\text{C}}}-\underset{\text{Cl}}{\text{C}}=\overset{\text{H}}{\text{C}}-\underset{\text{H}}{\text{C}}=\underset{\text{H}}{\text{C}}-\underset{\text{H}}{\overset{\text{Cl}}{\text{C}}}-\text{H}$$

APPENDIX B - AN ASSIGNMENT FOR BIOLOGY CLASS

Questions for "Bugging the Bugs"

1. Define each of the following words.

   a. inoxuous
   b. efficacy
   c. entomologist
   d. pheromones
   e. ubiquitous

2. List at least 2 reasons why chemical insecticides' usefullness is now being questioned.

3. What is "integrated control" of insects?

4. List at least 3 techniques used in "integrated control".

5. When and why did the U.S. first use biological controls?

6. Describe the method being used to control California's bollworm.

7. In what other ways are sex pheromones being utilized?

8. How are juvenile hormones being used to control insects?

9. What does Altosid SR-10 do to mosquitoes?

10. What does Dimilin do to insects?

11. What are "anti-hormones"? How do they affect insects?

12. List 2 disadvantages of using hormones and anti-hormones.

APPENDIX C - STUDY GUIDE AND TEST FOR BIOLOGY

Biology Chapter 4 Review Sheet

1. Define cell.

2. Describe Hooke's experiment.

3. Did Robert Hooke really discover cells? Explain.

4. What experiment did Dujardin conduct?

5. What were the contributions to biology of Schleiden and Schwann?

6. State the two points of the cell theory.

7. What recent discoveries have aided biologists?

8. Give an example of each of the following cell processes in humans.

   a. nutrition
   b. digestion
   c. absorption
   d. synthesis
   e. respiration
   f. excretion
   g. egestion
   h. secretion
   i. movement
   j. response
   k. reproduction

9. List the parts of a cell found in each of the following structures.

   a. nucleus
   b. cytoplasm
   c. cell wall

10. Describe how each of the following structures would look under a light microscope and give the function of each structure.

    a. nucleus
    b. nuclear membrane
    c. nucleoplasm
    d. nucleoli
    e. chromatin
    f. cytoplasm
    g. plasma membrane
    h. vacuolar membrane
    i. cytoplasmic matrix
    j. endoplasmic reticulum
    K. ribosomes
    l. mitochondrion
    m. lysosomes
    n. Golgi apparatus
    o. plastids
    p. cell wall

11. Define organelle.

12. Define:

    a. chlorophyll
    b. chloroplast
    c. xanthophyll
    d. carotene
    e. chromoplast
    f. leucoplast

13. Describe the internal structure of a chloroplast.

14. Describe the internal structure of the cell wall.

15. Describe the structure of primary and secondary plant cell walls.

16. Describe how the ultracentrifuge has aided the study of cell organelles.

17. Describe how radioautography is used in the study of cells.

18. Define:
    a. unicellular organism
    b. colonial organism
    c. multicellular organism
    d. cell specialization
    e. tissue
    f. organ
    g. organ system

Biology Test on Chapter 4

PART I: In the blank provided at the right, write the word or group or words which BEST completes the statement or answers the question. (3 pts each)

1. The biologist who first viewed living cells and observed that they had content was ?

2. The process by which insoluble, nondigested particles are eliminated by a cell is ?

3. The structural unit of all life is the ?

4. A series of double membranes which connects the plasma membrane and the nucleus is called the ?

5. The "suicide sacs" of the cell which contain digestive enzymes are called the ?

6. The material located in the nucleus of the cell which carries the cell's heredity is the ?

7. The yellow pigment found in cells is ?

8. The organelle believed to function in secretion and storage because it is often found in glands is the ?

9. A group of cells which work together to perform a particular function is called a (an) ?

10. The center for cellular respiration and energy release in the cell is the ?

11. The biologist who first saw cells by looking at pieces of cork was ?

12. The process of transporting food, water, and other essential materials from the environment into the cell is called ?

13. A group of cells which live together, but have no real dependence on each other form a (an) ?

14. The material which gives extra strength to the secondary plant walls of woody plants is ?

15. Small, spherical bodies in the nucleus which function in cell reproduction are called ?

16. The red-blue (purple) pigment found in beets is called ?

17. The plastid in the cell which has the function of food storage is the ?

18. Small, dense, spherical bodies which are found on the endoplasmic reticulum and function in protein synthesis are ?

19. The outer edge of an animal cell is called the __?__

20. The cells of the ovaries and testes are specialized for the process of __?__

PART II: Answer each of the following questions.

1. State the 2 points of the cell theory. (6 pts)

2. List 2 recent biological techniques which have aided biologists in discovering new characteristics of cells. (4 pts) Describe how each has been used. (6 pts)

3. Make a sketch of an Anarcharis plant cell. Label: cell wall, chloroplast, cytoplasm (8 pts)

4. Make a sketch of a human cheek cell. Label: plasma membrane, nucleus (6 pts)

5. Make a sketch of an onion cell to which iodine has been added. Label: cell wall, nucleus, necleolus, oil droplet (10 pts)

WORDS FOR PART I OF TEST ON CHAPTER 4

cell
hooke
Dujardin
Schleiden
Schwann
nutrition
digestion
absorption
synthesis
respiration
excretion
egestion
secretion
movement
response
reproduction

nucleus
nuclear membrane
nucleoplasm
nucleoli
chromatin
cytoplasm
plasma membrane
vacuole
vacuolar membrane
endoplasmic reticulum
ribosome
mitochondria
lysosome
Golgi apparatus
plastid
cell wall
organelle

chlorophyll
chloroplast
xanthophyll
carotene
chromoplast
leucoplast
anthocyanin
lignin
cellulose
pectin
unicellular organism
colonial organism
multicellular organism
tissue
organ
organ system

APPENDIX D

Algebra One Quiz

Given that $U = \{ 0, 1, 2, 3, 4, 5, . . . \}$ and $A = \{\text{all even whole numbers}\}$

1. Give the roster for set A.
2. Form set B, where the elements of B are obtained by multiplying the elements of set A by 5/2.
3. Form set C, where the elements of C are those elements common to both A and B.
4. Referring to the foregoing sets A, B, and C, indicate which of the following statements are true and which are false:

a. $C \subseteq A$ c. $A \subseteq C$ e. $B \subseteq A$ g. $A \subseteq B$ i. $A \subseteq A$

b. $C \subseteq B$ d. $\emptyset \subseteq C$ f. $a = B$ h. $33 \in C$ j. $303 \in B$

5. List all the subsets that can be obtained from $\{ R, E, D \}$.

With the universe of all the numbers you know, draw graphs for each of the following:

6. {0, 3, and all numbers between}
7. Graph set C from exercise three above.
8. {All numbers greater than 2}
9. {7, and all whole numbers less that 5}
10. {All numbers between 0 and 3}

APPENDIX E

Sociology Test - Chapters 1 and 2

Matching - In the space at the right of each definition, write the letter of the word it defined.

A. plurel	E. case study
B. group	F. pure science
C. society	G. applied science
D. hypothesis	H. community

1. Group of people living near each other in order to satisfy their daily needs.

2. A plurel in which people affect each other's behavior.

3. Research conducted for the expansion of knowledge, not for the sake of utility.

4. A social entity consisting of two or more people.

5. Largest group of people who share a unique way of life, occupy a definite territory, and think of themselves as a social unit.

6. Research conducted in order to make practical applications of scientific knowledge.

7. Group of people living near each other in order to satisfy their daily needs.

8. A piece of research which focuses on a specific group of people.

TRUE-FALSE - Place a T after each statement which is true and an F after each statement which is false.

9. In sociology, the comparative method involves the study of primitive societies and more advanced societies.

10. Sociology is the scientific study of the human individual.

11. Secondary groups are characterized by impersonal, non-emotional relationships.

12. The observation of data is the first step in the scientific investigation of a problem.

13. The essential quality distinguishing a human group from all other plurels is interaction.

MULTIPLE-CHOICE - Write the letter of the best answer in the space at right.

14. A family is an example of (a) a secondary group, (b) a primary group, (c) a society, (d) an association.

15. A football team would be an example of (a) a primary group, (b) an association, (c) an ephemeral group, (d) a secondary group.

16. Sociology is considered to be a social science because (a) Plato and Aristotle classified it as such, (b) it deals with human behavior, (c) its theories can be used by other social sciences, (d) it uses the laboratory technique.

17. The statement "poverty is a cause for crime," is sociologically (a) a fact, (b) a hypothesis, (c) a variable, (d) an exaggeration.

18. If a sociologist joined a submarine crew to study it, he would be (a) pretending he was someone else, (b) engaging in participant observation, (c) trying to get an outsider's view of the ship's morale, (d) locating inefficient members.

ESSAY QUESTIONS:

1. Why is a summer visitor or a tourist a poor observer and interpreter of a foreign country?

2. Can you explain why sociology is needed in modern times?

3. How does your community help you to meet your needs? List as many as you can.

ALAN PESHKIN

Alan Peshkin, Director of African Studies at the University of Illinois, has served as a Professor in the University of Illinois College of Education since 1967. He lives in Champaign with his wife, Maryann, and their three children.

Since receiving his Ph.D. from the University of Chicago in 1962, he has taught courses both in social studies teacher education and in comparative and international education. He is the recipient of a Guggenheim Fellowship (1973) for the study of the relationship between school and community in rural areas (forthcoming as Growing Up American: Schooling and the Survival of Community, University of Chicago Press). He is also the author of Kamin Schoolchildren, published by Holt, Rinehart and Winston in 1972.

To his participation in the CSSE project, he brings the insights of a specialist in comparative education.

Chapter 5

SCIENCE EDUCATION IN URBANVILLE: A CASE STUDY

Wayne W. Welch
University of Minnesota

April, 1977

5

Even in a day of television and air travel, the northwest--northern California, Idaho, Oregon, Washington, even if Alaska were not to be included--is one of the most remote parts of the country. The mountains, the ocean, the distances, the time zones, and a resentment against further in-migration place it beyond the touch and ken of most Americans.

But it is not beyond the touch of the economic, social, and political problems of the rest of the states. And the schools are not greatly different from many we found in Texas and Ohio.

Our observer, Wayne Welch, spent most of the fall term of 1976 in a high school he called Hardy High. He reported that the major forces pressing for change at Hardy were: (1) declining enrollments; (2) rising costs but failures at the polls of special levies; (3) desegregation legislation; (4) accountability pressures; (5) concern about children learning the basic skills; and (6) changing student attitudes. We were intrigued by his development of these forces against a background of subsystem enclaves. He found highly bounded administrative and teaching subsystems, both characterized by geniality and respect for the other--but both appearing to strive for minimum interconnection.

Some of the details of these things are not common to what we found across the country--for example, the absence of local funding for the schools unless the levies passed. But the general circumstances will be recognizable to Piedmont and Prairie readers. The constraints of teacher-strikes and bus-schedules, the football hyperbole, and the social etiquette of the lunchroom are almost universals--played out again *in this far corner to frame the science teaching and learning in Hardy High and its configuration of feeder schools.*

Wayne Welch is an expert in those forms of student testing and attitude measurement that relate to the science curriculum. On numerous occasions he has been an adviser to and a researcher for the National Science Foundation. We were pleased to find an observer to bring that special perspective to the scene. Perhaps more than any other of our observers, he has watched the success of efforts to reform the precollege science curriculum, and their lack of success. He knows the array of alternatives--pedagogical and substantive--that are potentially available to the American science teacher. His report should be read with a sensitivity to these opportunities--and the obstacles and costs.

SCIENCE EDUCATION IN URBANVILLE: A CASE STUDY

Wayne W. Welch

BACKGROUND

To many, the image of a large city high school is a three-story, dirty brick building erected about the turn of the century. The playgrounds are paved with asphalt, and guarded by six feet of chain link fence. Occasionally, classroom bulletin boards display a splash of color, but for most the dreary picture of schools painted by The Blackboard Jungle and Up the Down Staircase covers the canvas of our minds.

Such an image was in my mind prior to a recent study of science[1] education conducted in a school located in a large metropolitan area. But was this an accurate image? What does an American school in 1976 look like to an outside observer? What issues and problems occupy the minds and hearts of students, teachers, and parents? And can these concerns be recognized in an eight-week study? These, and other questions, are the focus of this report.

The specific purpose of the study was to portray as clearly as possible what is currently happening in science in a typical secondary school cluster. (A cluster is a senior high school together with its junior high school, and feeder elementary schools.) The methodology used is called case or field study research. This type of research is an intensive study of the background, current status, and environmental interactions of a given social unit: an individual, group, institution, or community (Issac 1971). Case studies are in-depth investigations designed to yield a complete and organized picture of the unit under study. Understanding is sought through observations, interviews, archival searches, and discussions. The observer becomes the chief research instrument for gathering information.

The target unit of the present study is the science education program of a school in a large (greater than 250,000 population) U.S. city. We will call the city Urbanville and use fictitious names for schools and faculty. The school was thought to be somewhat innovative, but with no special national reputation. The socio-economic status of the community was judged high prior to the start of the study.

The initial contact with the Urbanville Public Schools was made by the project headquarters at the University of Illinois. They outlined the purposes of the study and explained that an observer wanted to spend several weeks in one of their schools observing the science, mathematics, and social science programs.

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[1] In this paper, science is meant to include mathematics, natural science and social science.

Approval for such an undertaking was obtained at the district level following the submission of "three typed copies of the following: a) request to conduct research form, b) all questionnaires, tests, forms and communications that will be given to participants, and c) synopsis of the proposed study (if appropriate)." The Research Office responsible for processing the application was most cooperative and approval was obtained on September 15, 1976. However, the approval by the district did not insure cooperation of the target school, as each principal is free to decide whether or not to participate in studies of this kind. While permission for the study was being sought, Urbanville teachers voted to go on strike two days prior to the opening of school, the first teachers' strike in the school's history. The main issues centered on a fair layoff and recall policy, an end to mass RIFing (reduction in force), some program restorations, fair transfer procedures, an acceptable staff evaluation process and a union demand for an agency shop. Two years of severe budget cuts and declining school enrollment had created a situation where all teachers with less than eight years seniority had been fired on April 15. Although some were eventually hired back on one-year contracts by late summer, the uncertainty of the job situation created grave concern among the teachers.

On September 13, four days after the strike began, the schools were closed due to low attendance and the potential loss of several million dollars in state aid, while negotiations stalled. Eventually, compromise and the intervention of high state officials ended the ten-day strike. The teachers generally achieved their demands and school started again on September 22, approximately two weeks late. The teachers achieved a consistent lay-off and hire policy, and a closed agency shop for the teachers' association was approved.

While the strike was in progress, some background information on the district was obtained in the Research Office and from the science supervisor in the city. Finally, early in October, the first contact with the target school was made. (In this report, the school is called Thomas Hardy Senior High School.)

On October 4, I made my first contact with Mr. Don McKay, the principal of Hardy High School. A brief conversation on the telephone led to a 10:30 a.m. appointment on the following day. As I drove to the northern part of Urbanville on Tuesday morning, I felt some concern about my reception. Suppose he refused to participate? What effect had the strike had on the atmosphere of the school? It had been thirteen years since I last taught high school and I wondered how things had changed.

As I turned right on Evergreen Street and started down the hill, I noticed a sprawling yellow brick building outlined with white trim. A red, white, and blue Patriot (the school mascot?) painted on a single chimney stood guard over the school. A modern two-story building, about a dozen years old, was nestled in a large grass-covered valley. A raft of tennis courts was flanked by football and baseball fields, and several adults were jogging on a path that circled the gridiron. Several temporary buildings, painted a dull orange, were behind the school, and a large parking lot was filled with brightly colored cars. The whole setting was surrounded by an amphitheatre of green pine trees, yellow maple leafs, and manicured lawns leading from the street to single-dwelling homes. For a moment, I thought I had escaped the city boundary and had mistakenly arrived at one of the surrounding suburbs. But no, the silver block letters to the right of the white-pillared entrance clearly spelled out: HARDY HIGH SCHOOL, 1963.

As I pulled into one of four parking spaces marked VISITOR, I thought how far wrong my expectations for the appearance of the school had been. I locked my car doors and went through the main entrance. The halls were filled with students, talking and walking, and I was struck by how similar the picture was to the Milwaukee suburban school I left in 1963. I entered a door marked OFFICE and introduced myself. They were expecting me.

Mrs. Steel, the principal's secretary, ushered me into a large, neat office. Mr. McKay, the principal, rose to shake hands and motioned me to sit at a table surrounded by four pink molded chairs. We exchanged pleasantries about the weather and my newness to the area, and I proceeded to tell him about my mission. For the first thirty minutes he listened carefully, occasionally interrupting with a question. I was somewhat uneasy because I sensed he was skeptical of the idea. However, the uniqueness of the study, the opportunity to provide information to federal decision makers and the fact that his school was one of only ten in the country selected for this study seemed to capture his enthusiasm. By the end of the next hour he had told me all about his school, showed me about the building, and arranged for me to meet with the department chairmen in math, science and social studies. Furthermore, he had given me a room for an office, assigned a mailbox and provided unlimited access to the coffee machine. I had crossed that initial barrier and seemed welcome in the school.

Once the support of Mr. McKay was obtained, the other pieces seemed to fall in place quite easily. The department chairmen made it possible to meet the department faculties. The junior high principal, Mr. Arkin, learned of my presence at Hardy, and was very receptive when I finally contacted him. And all four of the elementary principals I visited were very helpful in making arrangements for my visits to their buildings. The cooperation and assistance of a key person, in this case Mr. McKay, the principal, seems a critical factor in studies of this sort.

Because qualitative research, in general, and case studies, in particular, have not been used a great deal in science education research and evaluation, some attention is directed toward the process in this report. It may be that the hindsight of experience will provide some guidance for future studies of this type and help the reader to better judge the validity of the conclusions. A summary of the methodology as it was carried out is found in the appendix.

THE CURRENT PICTURE

Hardy Senior High

Situated in a city with a dozen high schools, eighteen junior high schools, and nearly a hundred elementary schools, Hardy has a number of educational strengths. Its building is one of the newest in the city, and the area it serves contains many of the ingredients which are supportive of education. It ranks first in the city in percentage of homeowners (74%) and young adults (ages 25-44), and ranks second in the percent of parents who are high school (75%) or college (20%) graduates. An indication of interest in education is found in the fact that approximately 55% of the graduates eventually go on to college and eight or ten national merit finalists are common among the senior class.

Nearly 1600 students and fifty-seven teachers seem to live day by day in relative harmony and one gets the immediate impression of an active and friendly environment. Amid the poster-covered walls urging students to vote for this class president or to join that society are found mementos of successes in arenas outside the classroom. The girls' softball team (coached by the psychology teacher) is undefeated, the cross country teams (boys and girls) were first and second in the state meet, and the football team boasts a 7-1 record and includes a high school All American player. One senses a feeling of pride and accomplishment among the students.

The teachers are generally very experienced (most are over thirty-five) and seem competent in their respective subject areas. They are casual in dress and, with few exceptions, friendly and warm people. The reprimands heard through the open door of the vice principal's office, the frown on the face of the dean of students, and conversation in the smoky faculty lounge hint at an occasional problem not witnessed by the casual observer.

Science

The natural science program at Hardy is strong. It is paced by an active biology program team-taught by three full-time and one part-time teacher. Currently 472 students (93% of sophomore enrollment)[2] are enrolled in a laboratory course led by the department chairman. The classrooms are filled with science artifacts (birds, weather maps, rocks, specimens, snakes, etc.) and the spirit of the group can be portrayed by two episodes: an open session with students one day after school to discuss the implication on science of the presidential election, and a week-end assault on the walls separating the three biology rooms resulting in open portals that central administration had stalled on for nearly two years.

Probably 80% of the class time is spent by students working on experiments; and three different tracks (developed locally) are provided, depending on student ability. The course is patterned after college science courses and seems difficult for many of the students. However, teacher enthusiasm and interest seem to rub off on students and they rate the course very good. Marine biology, human physiology, mushrooms, and wildflowers are other courses offered as part of this strong program. Exactly which courses will be offered a given semester depends a great deal upon student interest. A college style registration procedure is used and if a given course doesn't "fill" (i.e., be selected by more than twenty-five students), then it may not be offered. Conversely, sections are added if student interest is high.

During the semester following the site visit, the life science enrollment was as follows:

Biology II	250
Molecular Biology	29
Marine Biology	53
Wild Flowers/Edibles	34
Human Physiology	53

Apparently some of those students in the first semester of biology opt for more specialized courses the second semester.

The first year of chemistry is currently taken by 146 students (27% of junior enrollment) and is taught as a laboratory science. The five sections of chemistry are handled by the physics teacher and a chemistry teacher who also teaches biology. The CHEM study texts are used and the course is viewed by students and teachers as primarily a college-prep course. A third semester of general chemistry and a semester of organic chemistry are offered if enough students register for these courses.

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[2] This figure is obtained by dividing the total biology enrollment by the number of sophomores. However, some juniors and seniors take biology and some sophomores take other sciences.

Physics may be taken in either the junior or senior year and currently sixty-eight students (13% of senior enrollment) are enrolled. About half the group are girls, which is perceived by students and teachers to be the result of changing female roles. Counselors, parents, and friends are relaxing their attitude that advanced science is only for males. The course has some laboratory components, but in general is taught more like a math class; that is, explain concepts, assign problems, correct problems, discuss difficulties. This routine is interrupted occasionally by exams or experiments, but the "doing of problems" dominates over the "doing of science" found in the other classes. The class is clearly for the academically elite and the teacher sees no need to try to increase enrollments. At one time the PSSC and the ECCP courses were used, but this year the Holt-Rinehart-Winston book, Modern Physics, is being tried and will probably become the district-wide text for next year.

The rest of the science program includes a semester of geology and a science seminar. The geology situation portrays quite well some of the current problems in the school. Because of staff cutbacks, the assistant principal was teaching one section of geology this fall. After two weeks of school, a displaced junior high teacher was assigned by the district office to teach math and science. He took over the geology class along with several math classes and the assistant returned to full-time administration. The new teacher was encountering some difficulties in the class because students were irritated by the changes. In fact, in one class, there were four different teachers during the first month of school.

An adjunct to the science program is a popular horticulture program offered in the industrial arts department. In a temporary building and greenhouse located about two blocks from the main building, 113 students were enrolled in environmental horticulture. The course meets the state requirements for a laboratory science and while it is considered a strong program by the science teachers, there seems to be very little interaction between it and the rest of the science program. It has grown through the efforts of an active teacher whose academic home is industrial arts.

The science program is strong and surviving, but it is being subjected to many challenges: transfer teachers, declining budgets for texts and equipment, and competition from the "basics." It may be seriously affected if subjected to many more problems.

Mathematics

Mathematics at Hardy High School is traditional in its components, sequence, and text books. Its five full-time teachers are experienced (average age is over forty) and appear to be competent in their mathematics training. The staff also includes four part-time teachers who are shared with other departments: science, physical education and language arts. These teachers are younger, yet with one exception were thought to be qualified in the subject.

One year of math in grades nine--twelve is required for graduation. A three-year college-prep sequence that follows ninth-grade algebra is offered. In addition, there is an accelerated or honors track, and two options for non-college bound students: basic math, and a two-year algebra sequence. Current sequences and enrollments are shown in Table I.

TABLE I
HARDY H.S. MATH PROGRAM
(Fall 1976)

Grade	College Prep	Advanced	Other	
10(522)	Geom(245)	Geom (Honors) (29)	Algebra I (99)	Basic Math (44)
11(542)	Alg-Trig(121)	Adv Math(32)	Algebra IIA(50)	Basic Math (39)
12(506)	Math Anal(29)	Calculus(28)	-	Basic Math (66)

( ) Enrollments are shown in parentheses

There are thirteen classes with 395 students in the regular college sequence. One class at each grade level is in an honors sequence. The eight classes of basic math are part of a "minimum competency" program recently inaugurated at Hardy. All students must pass (get 70%) a basic skills exam prior to graduation (although the rule has yet to be enforced). In addition, this Minimum Competency Test is a prerequisite for the two-year introductory algebra sequence.

Conventional textbooks with 1960s copyrights are used in most classes. Textbooks by Dolciani had been most often selected. In all math classes I visited, the sequence of activities was the same. First, answers were given for the previous day's assignment. The more difficult problems were worked by the teacher or a student at the chalkboard. A brief explanation, sometimes none at all, was given of the new material, and problems were assigned for the next day. The remainder of the class was devoted to working on the homework while the teacher moved about the room answering questions. The most noticeable thing about math classes was the repetition of this routine. Although it seemed boring to me, students and teachers seemed comfortable with it. Apparently it fulfills student expectations and provides the students opportunity for closure.

Social Studies

Although NSF and university professors may think in terms of social science, the program at Hardy is better described as social studies. It enrolls nearly 1100 students handled by a faculty of nine teachers (teaching load is five periods during a six-period day). Five are full-time in the department while the other four are shared with music or foreign language.

The variability in experience, style, and quality seems greater among these teachers than in science and math. The department contains two teachers considered the best in the school by many students, and also two of the poorest. Classes I observed varied considerably as well; in one instance, I witnessed an exciting small group discussion in the learning center on conflict resolution, while in a U.S. History Class I saw an Encyclopedia Britannica film on the Virginia Constitution which was deemed so important that no mention was made at all of the previous day's presidential election. The teacher's rigid lesson plan and his failure to relate to students resulted in a missed opportunity to make history "come alive."

The graduation requirements in social studies are greater than the one year required in science and math. Sophomores must take a semester of world history and juniors need a year of U.S. history. A semester of the state history is required, but it may be taken in junior high school. Until this year, a course in "Problems of Society" was required at the twelfth grade. This requirement was dropped by the state but is still offered as an elective. Offerings and enrollments are shown in Table II.

TABLE II
HARDY H.S. SOCIAL STUDIES PROGRAM
(Fall 1976)

	Grade		
	10	11	12
COURSES OFFERED	World Hist(9)* State Hist(1)	U.S.Hist(18)	Contemporary Society(2)
			Psychology(3) Anthropology(2) Economics(1)

*Numbers in ( ) are the number of sections. Each section is about 30 students.

Electives in the Far East, the Soviet Union, and one called "War and Peace" are available during the spring semester. The number of sections offered, if any, depends upon student requests. And student requests seem to depend a great deal on peer and sibling advice.

Jefferson Junior High School

Located across the street from the high school in a two-story brick building erected about 1953 is the week-day home of 1360 seventh-, eighth-, and ninth-grade students. Fifty-four teachers, three administrators, three counselors, a nurse, five secretaries, seven custodians, nine lunchroom staff, and a human relations associate are charged with preparing students to make the move across Evergreen Street to Hardy a relatively easy journey.

The building is older, seems more dreary than the high school, and the pushing and shouting in the halls creates a much different atmosphere. Classroom behavior is good, however, and the staff generally appear capable, although more uncertain of their ability than Hale teachers. (Perhaps this mirrors the anxiety of their twelve- through fourteen-year old students.) Like their Hardy counterparts, they are experienced teachers (most in their thirties and forties) and seem competent in their subject. Nearly all are teaching in subjects in which they have majored. The school is very similar to the high school. The philosophy, curriculum, daily schedule, organization, even the lunch room program are patterned after the big brother across the street.

Science

The science program at Jefferson has several strong teachers, but has been cut back in recent years as more and more electives are sacrificed for required courses. An active faculty of four provides the required semester of biological science in seventh grade and physical science in eighth. An elective class of oceanography and one of earth science are all that are taken in the ninth grade. The science is strongly lab oriented (although less so in eighth grade), and two of the teachers run several science field trips a year--some of two weeks duration. The textbooks are conventional, but the courses contain many teacher-developed diversions from the printed pages.

Mathematics

A full year of mathematics is required for seventh and eighth graders, and nearly all ninth graders (98%) elect a full year of math. The ninth-grade class for the average or above average student is algebra. Those students in the accelerated program of seventh and eighth grades take an accelerated algebra course. (Approximately half of these opt for the honors geometry course in tenth grade.) A general math course is available to ninth graders, apparently for the below-average student, which satisfies the ninth-through-twelfth-grade math requirement or is preparation for the two-year algebra sequence.

Again, as in the high school, the math program is characterized by its conventional textbooks and its routine of correcting papers, explaining difficulties, and assigning more problems. Enrollment in mathematics is high, and the district priority on mimimum competency in reading, language arts, and math should keep it that way.

Social Studies

More social studies courses are required at Jefferson than science courses (five semesters compared to two in science). State history and U.S. history are required in the seventh grade. A semester of world geography is mandated for eighth-grade and students choose an elective for the other half year. About fifty eighth-graders choose civics and urban studies; but typing, piano and health education are strong competition for a second semester of social studies. In the ninth grade, a year of world history is required of all students.

Eight full-time teachers comprise the social studies department. They have an average of nine years experience. Here, as at Hardy, considerable variation was noted among the classes in content, style, and interest. However, description and recall are far more prevalent in class discussions than inquiry or analysis.

Elementary Schools

A typical elementary school in the Hardy cluster of the city of Urbanville contains about 300 students (K-6) and fourteen teachers including a librarian. Those schools enrolling fewer than 300 pupils are assigned a half-time librarian. The principal serves a unique role of boss, shepherd, counselor, and manager all rolled into one. He/she is usually the major factor in the school's operation, as teachers seem more deferent to the principal than in the junior or senior schools.

The physical appearance and the emotional climate vary from school to school, with some being open, bright, and cheery, and others being closed, guarded and dreary. To some extent this mirrors the personality of the principal, but it is difficult to assign a cause-and-effect result. Children at this age are delightful and it isn't long before a smile crosses your face as you watch their unbounded enthusiasm and curiosity. Sometimes this energy competes against the rules and order desired by the teachers.

Elementary teachers seemed happier in their job than did their secondary counterparts. There were more smiles and fewer complaints in the teachers' lounge. The battle lines between students and teachers are not so clearly drawn and learning seems more of a joy than a conflict.

Reading and language arts dominate the curriculum, even at the upper levels. Mathematics is a distant second but it is considerably ahead of anything else. Principals rank the relative emphasis at the elementary level this way:

1. Reading
2. Mathematics
3. Social studies
4. Physical education
5. Health/science
6. Music
7. Art

A reported schedule of a sixth grade teacher also illustrates the situation.

9:00 - 10:00	Language arts
10:00 - 10:10	Recess
10:10 - 11:00	Math
11:00 - 11:40	Social studies
11:40 - 12:30	Lunch-recess
12:30 - 12:45	Spelling
12:45 - 1:20	Language arts or math again, depending on problems
1:20 - 1:30	Recess
1:30 - 2:30	P.E., science, art, music, health

This schedule, or one like it, is typical of all the elementary schools. Science competes with art, music, health (sometimes considered science by teachers), P.E., and whatever else may impinge on the end of a school day, e.g., parent conferences scheduled for two weeks. And science is losing the battle. It receives very little attention.

The curriculum guide for the district, which is seldom used by teachers, recommends about ninety minutes a day for language arts (including reading), about forty minutes per day for math, and thirty each for science and social studies. Other subjects are recommended lesser amounts. Greater influences on teacher decisions are principal pressure, or encouragement, and current district priorities. The latter currently are on such things as minimum competencies in reading and math, desegregation, accountability, and public relations in the community. Science and social studies are being largely ignored.

Probably the most important observation for the purposes of this study at the elementary level is the small amount of science that is being taught. Only an occasional teacher or principal who is interested in the area generates interest that may spread throughout the building. Otherwise, one is most likely not to see any science at the elementary level.

Social studies is given more attention, but even this is diminishing as the move for competency (with its increased time requirements) and other demands grow. Teachers seem to be willing to teach social studies more than science, but less and less time is available.

Mathematics occupies a valued position in our schools these days. This is somewhat surprising, given that most students find it boring. However, parents, boards, and teachers see it as an important skill, and drill on long division appears with greater frequency in the classroom. The "new" math is now old, and -- with cries of "Johnny can't add!" -- is rapidly disappearing from the curriculum.

So too in science one must look hard to find a SCIS lesson or an ESS unit. USMES, Minnemast, and MACOS are foreign words to most teachers. Traditional text series occupy the shelves. Teachers who tried some of the newer curricula have changed back. Except for the impact it produced on the commercial texts, the NSF curriculum development venture in Urbanville is a thing of the past.

SOME LENGTHENING SHADOWS

Although Thomas Hardy High School is making good contributions to the education of the students of north Urbanville, the system has undergone severe pressures the past half dozen years that present a real threat to the school. Major socioeconomic forces have immediate effects. For example, the loss of a special bond issue reduces the number of elective courses. The system can accommodate a number of shocks, but sooner or later it begins to react, sometimes violently, sometimes more subtly. And although the educational institution in this country is extremely resilient, it can be hurt by severe and persistent forces. The major forces, their immediate impact, and some growing reactions as I see them, are outlined in Table III (see page 5-11).

A strong impact on this district has come from the decline in numbers of school age children. From a high of 100,000 pupils in 1970, the enrollment has dropped to 60,000 in 1976. Decreasing birth rates, outward migration of younger families and, to a lesser extent, transfers to private schools have all played a role. Enrollment figures for the past twelve years at Hardy tell the story.

YEAR	PUPILS	TEACHERS
1964	1875	81
1965	2002	83
1966	1984	88
1967	2132	94
1968	2150	95
1969	2221	96
1970	2142	92.5
1971	2112	90.5
1972	2053	83.5
1973	1939	80
1974	1833	71.2
1975	1688	72.2
1976	1576	57

The situation is the same in the feeder schools. From the high water mark of 1969-70, there has been a 30% drop in number of students and a reduction of 43% in the number of teachers.

Coupled with this decline has been the difficulty in passing the yearly bond issue required to raise the per-pupil expenditures above the state-provided minimum of $725. The special levy failed in 1974-75 for the first time, causing much belt tightening; and the budget of the current year is far below what the teachers and administrators believe is needed. But a public offered an opportunity to vote against rising taxes in an inflationary

TABLE III

FACTORS AFFECTING THOMAS HARDY HIGH SCHOOL

MAJOR FORCES → **SHORT TERM IMPACT** → **SOME REACTIONS**

MAJOR FORCES

1. Declining enrollments
2. Inflation/failure of special levies
3. Desegregation laws
4. Accountability movement
5. Concern about basic skills
6. Changing student attitudes

SHORT TERM IMPACT

a. Teacher firings

b. Reduction of support services

c. Aging texts & teachers

d. Less equipment/supplies

e. More classroom space

f. Fewer electives

g. Minimum competency programs

h. Less flexibility

i. Greater demands on teachers/administrators

j. More red tape

k. Public relations sensitivity

l. Teacher transfers

m. Special skill development programs

n. Racial problems

o. Fewer discipline problems

p. Increased student interest in school

SOME REACTIONS

A. Increasing teacher militancy, strike, growth of union

B. Less satisfaction with teaching

C. Separation of institutional, managerial, and technical systems period becomes a force to be reckoned with. More often than not, the final school budget is not determined until late summer. At present, all teachers with less than eight years seniority have been fired and have lost their seniority. Many have been hired back in August for one year, but the fear and uncertainty for the future year are great. One teacher told me she has been fired and re-hired seven years in a row. Because there are few new teachers being hired, the average age of the remaining teachers is increasing.

District budgets for the past three years have been $116 million, $110 million, and $108 million. The drop in purchasing power is even greater, of course. In addition to teacher RIFing, there have been cuts in support services (e.g., curriculum specialists, librarians, demonstration classrooms) and less money for laboratory equipment and supplies (even paper is becoming a commodity). Texts are not being replaced. Most copyright dates I saw were about 1965.

The school day has been shortened from six to five periods with no study halls, and the number of electives has been reduced. Flexibility in scheduling and opportunities for innovations are practically non-existent, except within the classroom. One positive outcome has been the increase in available space, but more often than not this means un-used and empty rooms.

Desegregation and other federal laws have created their share of problems for the day-to-day operation of the schools. Last year, fourteen Hardy teachers were "displaced" to other schools because of reduced enrollment and the need to make places for incoming minority teachers. While the purpose of such a program is admirable, the impact on people's lives is enormous. (For example, after teaching at Hardy High School for eight years, Miss Wainwright found out on September 5 that she will be teaching a new subject at a school fifteen miles from where she has been teaching.) Because of such impact, teachers and administrators try hard to keep these "career reconstructions" at a minimum, regardless of the social causes they might serve.

Although bussing has not been implemented in Urbanville, there is a strong movement for admitting voluntary racial transfers and other forms of desegregation. Four years ago, the mixing of Asian, black, and white students did create some problems leading to a brief student riot. But racial strife is not apparent now. Left over from more troubled times is a security officer who seems to have little to do, two human relations staff, several minority clubs, and a host of problems for administrators, counselors, and teachers. Future integration plans (e.g., magnet schools) are likely to create even greater demands on the system.

Parents of Hardy students have expressed considerable concern for public institutions. The community is demanding that organizations such as the medical profession, bureaucracies, and schools be responsible for providing their promised or expected services. In addition, parents are concerned about declining test scores and the apparent inability of their children to spell, read, write, and compute. These concerns and interests have led to greater demands on teachers and administrators resulting in such things as management by objectives, performance goals, and the publication of test scores by school building. The paper work and red tape have increased exponentially as principals ask teachers for their statement of yearly goals and central administration asks principals for their building goals.

Evaluation of teachers is increasing (with its attendant anxiety); district courses such as "Positive Image Building and the Educator" are available for teachers. The potential value of these teacher evaluations, though, is uncertain. Evaluation creates anxiety and tension, perhaps justified, perhaps not. It is seen by some teachers as debilitating rather than supportive. It's a nuisance to them and its value in improving the act of teaching and learning is unknown. Certainly these problems take time and create pressures on teachers, but perhaps the gain will be worth the cost.

Also having a far-reaching effect on the schools is the growing interest in developing minimal competencies. Parent concern, desegregation, and declining budgets all work to make "basic skills" an attractive focus. This creates much support for language arts, reading, and mathematics. There is decreasing interest in other subjects, including science, because they are considered by some parents not to be "basic."

Meanwhile, a positive force impinging on the Hardy schools is the apparent shift in the attitude of students toward schooling. It is far from meeting most teachers' ideals, but better than the violent objections of a few years ago. The cause of this change is unknown, but the atmosphere--as reported by teachers--is improved from the turbulence of the late sixties on college campuses and in high schools.[3] Peer pressure to "drop out," reject traditional values, or rebel seems to have vanished. In spite of, or perhaps because of, the pressures surrounding the classroom, one senses a positive attitude about learning among many students at Hardy school. This perception is not shared by all teachers, however, as complaints about "poor attitude" are occasionally heard. The changing attitude was not apparent at the junior high school, but did reappear again at the elementary schools. The result has been fewer discipline problems than five years ago, and shared goals seem to exist between student and teacher in many classrooms.

What, then, has been the outcome of all these pressures? I think it can be summarized by stating three growing reactions. First, there has been an increase in teacher militancy as teachers seek to find protection from the factors that threaten their positions. Teacher unions have become activist and the issue reached a peak this fall with the first strike in the district's history. The teachers seem to have found strength in the strike experience. More than one teacher reported the strike brought the teachers closer together, in addition to increasing their salaries and future negotiating strength.

Second, teaching appears to be less satisfying. There are more demands and fewer rewards. In my opinion, teaching always has been difficult. Recognition of this difficulty, which I believe grows in part out of the difficulty in learning, helps to explain many things one observes in the schools. For example, teachers tend to resist those things that make their job more difficult and are attracted to those things that make it easier or more effective. Resistance to innovation, appeal of teaching bright students, need for discipline, desire for smaller classes, resistance to administrative requests for personal goals are all explained by considering teaching in this light. At the Hardy cluster, the rejection of the newer but more difficult to teach science curriculum materials, and the reversion to a traditional text are manifestations of the phenomena.[4] (Obviously, this conclusion is not shared by everyone. Neither is the disappointment with multiple texts, nor the annoyance with progress reports, the absence of art and music in the elementary classroom, and the decline in the number of science classes.) This hypothesis (teaching is tough, and getting tougher) also explains the acceptability on the part of teachers of the "back to basics movement," and explains why math teachers so readily fall into a standard routine. These things all make the job of teaching easier.

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[3] However, one teacher in reading this report wrote, "[There is] a greater emphasis on jobs and competition--less on learning and idealism. Many of us did not find the 69-74 era a threat--it was almost inspiring."

[4] Again, a teacher's reaction to my statement is enlightening. Someone wrote, "In biology not a proper conclusion. BSCS was dropped, in part, due to lack of interest on the part of the student--the students did not like the green version (or blue). It was boring. They found that the book had little to offer. As a result we kept the labs, rewrote some, added many more--developed three levels of difficulty (three separate lab manuals) in an attempt to increase student involvement. More students are now involved--students of diverse backgrounds (LLD, and very bright, etc.) can all function in the same class. I don't think that this was easier than using the NSF curriculum."

Finally, I believe the pressures on the school have created a situation where the systems responsible for providing the education of children have drawn inward and moved apart. The attention-directing factors and the relevant variables at the institutional level (central office/school board), the managerial level (principals), and the technical level (teachers) have always been somewhat different and the situation seems to have worsened. Teachers are responsible for the day-to-day operation of the classroom; principals serve as linkages or buffers between the technical level and the central office, which is concerned with exchange relationships with the environment, the community, and state and federal offices.

Each of the systems now seems to be functioning as a self-contained and separate entity. Mutual support is minimal. When the systems do interact, it creates tension or problems. The principal's staff spends hours developing and explaining complicated tardy and absence forms. Five tardies equal one absence! Five absences equal one suspension! But the teachers ignore this system. Although I saw the system explained for two hours on two different occasions by the assistant principal, not once did I see a student marked tardy, although there were many in the thirty-three classes I was in at the start of the period. The interest in tardiness at the managerial level was not shared at the technical level.

The teachers look to the managers for support, and in return they receive demands for "goals and objectives," reduced supplies budgets, fewer elective classes to teach (often the most interesting), increased class sizes and decaying textbooks. In spite of a very competent principal and because of situational constraints, the direct assistance provided to teachers during my two months of field work was minimal. Most of the interactions involved administrative requests rather than administrative giving. At the central office level, this lack of, or reduction in, support was very noticeable. The loss of mutual support among the technical, managerial, and institutional levels may be a problem to education in Urbanville. In the face of external pressures, the three systems should be working together, not drifting apart.

In my opinion, the existence of these three reactions -- teacher militancy, tougher teaching, and separate systems -- is important when planning for change. These reactions together with the external factors and the immediate impacts describe the setting in which the science education is occurring.

POTPOURRI

A number of observations and conclusions were not woven into the preceding story, yet their existence is important in this case study. Time and space limitations do not permit elaboration, but some of these items may help the reader to better understand this and other school clusters. Caution is urged in generalizing these notes beyond the current site.

1. The percentage of girls enrolled in the science courses in the high school is increasing. Students say this is due to encouragement from counselors, parents, and siblings to expand the roles for women.

2. The problems, issues, concerns, and needs are different for social science, mathematics, and science. They are also different for elementary, junior and senior high schools.

3. Many elementary schools have "glow" teachers who become leaders in various aspects of the curriculum. For example, there might be the SCIS teachers, or the MACOS teacher, or one particularly interested in math. Fifth and sixth grade male teachers seem to fill these roles most often.

4. As yet, the within-class activities have not been affected much by the changes in the political and fiscal environment. It seems to be just starting and no doubt will increase.

5. Hardy's experienced and able teachers found the National Science Foundation Institutes very valuable for exchanging teaching ideas and maintaining currency with their subject matter.

6. The high school football coach seemed to be an effective basic math teacher.

7. Abilities and personalities of teachers vary considerably. However, most I observed seemed quite effective.

8. Students and teachers seem to fulfill each other's expectations of their respective roles in the classroom.

9. Observations and testimony seem to confirm that secretaries in the schools are overworked.

10. A per-student science equipment budget of $1.25 for supplies and equipment is perceived by the staff as woefully inadequate.

11. Parents and elementary teachers are opposed to the use of calculators in math. They worry about not learning skills and becoming mentally lazy.

EPILOGUE

This report has presented the results of a case study designed to portray science education in a school located in a large urban area. The names of the schools and the faculty have been changed to preserve anonymity. The purpose of the case study was to apply a new methodology to the problems of science education for the purposes of helping to illuminate desirable future directions.

Tests, questionnaires, regression equations, and ANNOVA's, the tool kit of most science education researchers, are noticeably absent from this research study. But hopefully, greater understanding through description and analysis has occurred. The ultimate test of this or any other approach will be decided by those charged with the responsibility of making decisions concerning the future of science education. If this case study is found useful for making decisions or identifying areas for future study, then this methodology would seem to have a role in evaluation and science education research. The passage of time and the experience of further study will help us decide the value of that role.

Meanwhile, I now leave the yellow brick building, trimmed in white, with the school mascot painted on the chimney. I thank the friends I have made there for opening their classes and hearts to me. I hope I have done them justice by telling their story accurately.

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APPENDIX - METHODOLOGY

In retrospect, it seems important to summarize the field work methodology and to describe the sources of data. Perhaps this will help the interested reader in judging the accuracy and pervasiveness of the conclusions of this study.

The data were obtained from six different sources: (1) semi-structured interviews (typically one hour long) where notes were taken concurrently; (2) in-class observations using a class observation form; (3) school documents such as daily bulletins, enrollment sheets, and the school yearbook (a valuable way to learn teacher and student names); (4) meetings I participated in or attended; (5) informal discussions in the hall, lunch room or teachers' lounge; (6) informal perceptions from just moving about the building. The data sources were of two general types: semi-structured, which included interviews, class observations, documents, and meetings; and unstructured, which included discussions and perceptions formed from watching and listening.

The traditional research criteria of validity and reliability play a different role in case studies. Case study results must be judged on such criteria as source criticism, recording accuracy, the relationship of the field worker to the unit under study, sampling, and the scope of the data sources.

The specific sources within each of the six categories are listed below.

Interviews

Semi-structured interviews were held with about fifty people during the eight weeks of the field work. The main selection criteria were likelihood of possessing needed information, availability, and representativeness of various groups: teachers, students, parents, etc.

At the district level, I interviewed the science supervisor and staff in the Research Office. The principals of each of the six schools (high school, junior high and four elementary) were interviewed extensively as well as selected support staff: registrar, counselors, and assistant principals. The department chairmen for math, science, and social studies at the junior and senior high school and fifteen teachers provided the bulk of information during the field work phase of the study. In addition, six parents, eight students, and two alumni were also very helpful in describing their impressions of the Hardy cluster of schools.

Class Observations

A total of thirty-three elementary and secondary classes were observed for one class period and records made during the visit. Duration of these observations was usually fifty-five minutes. In addition, drop-in observations (here defined as ten minutes or less) were made in twenty-three classes. These were unannounced visits made either by listening through open doors or by walking in on laboratory experiments, student assignment time, or the instructional resource center where many of the social studies classes were held. These brief observations were intended to check on points noted in a previous visit and to observe classes in a more typical environment than one might expect during an announced class observation. (Parenthetically, it might be added here that very little difference was noted in lesson plans, teacher activity, or student behavior for announced or unannounced class visits.) All schools seemed fairly comfortable with the presence of observers. Probably this is due to a number of interns and student teachers found in these buildings.

The summary of classes visited is found in Table I.

TABLE I

Class Visitation Summary

Hardy Field Work

	Sr. H.S.	Jr. H.S.	Elementary	Total
Natural Science	12	6	4	22
Social Science	7	4	3	14
	9	6	5	20
	—	—	—	—
	28	16	12*	56*

*Two classes in kindergarten and first grade were quite general and classification is based more on teachers' intentions than on actual activities.

The attention directed toward natural science (39% of the observations) is less than planned and reflects in part the fewer science classes offered in secondary school and the limited time devoted to science at the elementary level.

Documents

Many documents were perused to gain understanding of the field site. They are too varied and numerous to list completely but included such things as textbooks, tests, curriculum guides, course offerings lists, textbook adoption guides, school files, daily bulletins, school annuals, school newspaper, and the local city newspapers. A teacher's box was assigned to me for the two months of this study and I received copies of everything that went to the teachers. In addition, specific information on the district was available from the central office.

Meetings

Several meetings were attended where it appeared a better understanding of the school* might be gained. The field work at the meetings was usually to listen and watch and to record impressions. If the recording could not be done unobtrusively during the meeting, then it was done immediately afterward.

Meetings attended included meetings of the total faculty, science, math and social studies departments, instructional council, new teachers, parents, and students. About half were convened as part of this study. The remainder were normal meetings of the groups to which I was invited.

*The reader is reminded here that "school" refers to the target secondary school as well as the "feeder" elementary and junior high schools.

Discussions

An unknown adult in a school building is noticed almost immediately by curious teachers ("May I help you?") or students ("Who are you?"). Even custodians seem alert (anxious) to assume a hall monitoring role ("Are you looking for the office?"). This interest always seems strange to me, given the public nature of schools and my recent life on a university campus. It is somewhat like entering a federal building in Washington during the bomb-scare days of the sixties, or approaching the floor nurse in the obstetrics wing of a large hospital.

But this curious (helpful?) attitude does generate many opportunities for informal discussions. Field work in schools is filled with brief personal interactions: in the hall, lunch room, teachers' lounge, and even the rest room. And while recording these incidents is difficult, they occur with such frequency that I have no doubt they contribute to the wealth of information impinging on the field worker.

While I tried to use these instances as ways of uncovering "hidden truths" or discovering new issues, they were for the most part kept at the level of "Are you a new substitute?" "No, I'm here observing your science program!" Or, "How do you like the weather in Urbanville?" They did provide a way to meet the teachers and become less of a threat in their class and to substantiate a number of observations made in the school buildings. (Example: "Miss Jones, the students in this school seem quite well-behaved!" "Yes, although I wish they weren't so noisy in the hallways!")

My records show more than two dozen such contacts and there were probably twice this many that had some input into my data-gathering instrument.

Perceptions

Finally, a great deal of time was spent watching the actors in the school drama: students, teachers, administrators, janitors, parents, and others. These actors created impressions as did the facilities, equipment, broken windows, clean floors, smoking area, hall posters, faculty dress, student dress, vice principal, minority students, football games, open house, and lunch rooms. Tht totality of these visual and audio inputs cannot be quantified, but my impression is that they influence the field observer a great deal. Noticing the need to hit or shove peers in the junior high, or an un-monitored, yet orderly lunch room in a senior high, cannot help but have a perceptual impact. It is the set of these received impressions that seems an important part of the methodology of case studies.

As a validity check on perceptions and other data, other observers were brought into the school for short periods and the case study report was reviewed by the principal and department heads. Nevertheless, whether or not others would respond to and remember the same stimuli is uncertain. The wealth of sensual information may be the field worker's greatest ally, but it may also be an enemy. A single dramatic event can have more influence on one's senses than a dozen common occurrences. The observer must guard against this uniqueness phenomenon.

GREATER SEATTLE SITE VISIT

To illustrate the use that this CSSE project made of site visit teams, the team report for the GREATER SEATTLE site is included next. The principal reasons for these visits were:

a. to confirm principal observations reported in the case study by the field observer

b. to assist in the development of "scenarios" for the national survey questionnaire

c. to identify new issues in contemporary science teaching and learning

d. to assist the observer in making certain special observations, interviews and interpretations

e. to further the coordinator's preparation for writing the assimilation chapters.

The site visits were conducted differently at different sites, partly because the needs of the field observers varied and the needs of the project changed. This GREATER SEATTLE visit was the first of the site visits.

The five reports are included in the informal form in which they were submitted. (Coding and omissions of names were done to preserve anonymity.) Note might be made of the difference in attention the individual visitor gave to pedagogy, subject matter, organization, and the relationships of school activity to university-based activity.

REPORT FROM THE SITE COORDINATOR

The first CSSE site visit was held in Greater Seattle November 1-3, 1976. Coordinator Bob Stake arrived October 24 to make arrangements. Assistance of the District Office was sought but little was received; but on the other hand, no obstacles were raised. The principals of the three schools to be visited made arrangements for interviews in their buildings.

Field observer Wayne Welch had been in the Hardy vicinity (high school, junior high, and elementary schools) since early October. He had been well received and made it easy for site visitors to do their work. He did not participate fully in the visit but did attend some sessions, particularly when the interviewees were people he would not have time to see individually.

This portion of the Seattle area has many of the characteristics of an older suburb. Most people live in single-family dwellings--with yards, gardens, and trees well developed. There are older business-lined arterial streets and at least one relatively new shopping area. Puget Sound and Lake Washington are not far.

The staff at the three schools are highly experienced. Many came here after serving earlier years in other schools. Few were younger teachers. Many of the younger ones are veterans of annual discharge and August rehiring. Budget limitations required an annual reduction in force (RIF'ing), but some of them had to be brought back to get school going each fall. A few teachers had been assigned to these schools to improve the racial balance. Budgets this year were not as spare as the previous two years, but there were many references to the shortage of funds for the schools.

The site visit team consisted of:

Arnold Arons, physicist, University of Washington
Jack Easley, mathematics educator, University of Illinois
Jennifer James, anthropologist, University of Washington
Howard Levine, evaluator, formerly of NSF, now at Berkeley, California
Bob Stake, coordinator, educational psychologist, University of Illinois

Efforts to add a local school administrator and a parent to the team were unsuccessful. Mr. Levine graciously agreed to join the team at the last minute so that the scheduled interviews could be carried out. Arons, Easley and Stake met on Sunday evening to discuss the schedule and aims. The other two joined the party the following morning. Professor Arons was unable to participate after Tuesday noon. All members wrote reports of their observations and these are appended.

An "open session for students or teachers who might want to speak to the panel" on Tuesday afternoon drew no respondents. The team used the time to discuss its observations and findings. Other sessions came off as scheduled.

Three sessions were held with teachers during their noon hour, a period of only 40 minutes. Although we arranged a lunch for them, the time went by much too quickly and these were perhaps our least productive sessions. Throughout the visit we frequently found ourselves in groups too large, and toward the end we found ways of splitting up for individual interviews. The large groups permitted respondents to react to each other, but it limited the time that any could speak, and perhaps for some, limited the frankness with which they would speak. Although team members wearied a bit of the descriptions of the programs in those schools, and occasionally felt the victims of puffery, for the most part they found the respondents candid and anxious to help.

By and large, the school people, parents and students were pleased with the programs of course work in their schools. They considered most of the teachers competent and conscientious. They were favorably impressed with administrative support at the building level. They expressed reservations about support from district offices--some of it contradictory--such as wanting more directives from district offices as to what should be taught, and at the same time believing the district officers have too little confidence in what teachers could take care of by themselves.

There appeared to be a strong feeling of need for greater uniformity of what will be covered in elementary courses, at least as a minimum accomplishment for "all" children. They wanted more communication among teachers and administrators, both as to what should happen and as to what was happening. Many respondents indicated that the goals of instruction should be more fully specified. Few indicated that the district faces the danger of having its goals lowered in order to achieve a greater uniformity of results. Few teachers expressed fear that they might be expected to teach lessons they were not capable of teaching or did not enjoy teaching, a possibility if a set of instructional objectives were to be required by the district.

A number of teachers bemoaned the loss of public support for the sciences. Math teachers seemed to see the support they wanted, but felt a need for materials and techniques for teaching older kids the basic operations not learned earlier. Social studies teachers did not feel that there ever had been support for teaching social "science" in the pre-college years, and were not particularly advocates of it themselves. When asked about the difficulty of teaching sensitive or taboo topics, none of them indicated that they had heard any trouble of that kind in these schools.

Enrollments in the various courses was dropping as total enrollment in these schools dropped, but not disproportionately. For graduation, a year of science was required, and most students took biology. It was reputed to be easier, more fun, less involved in mathematics, and less of a threat to the grade point average. Few people named this or any other high school course as containing subject matter that an educated person "just ought to have." Students enrolled in science courses or did not, as if there was rather little choice, once you decided whether or not you might be going to college.

It was surprising perhaps that there was not more feeling about whether or not geometry or physics were basic to an education--certainly there was lots of talk about basic education. For the most part, people were very much in favor of the basics, and by this, most of them meant reading and arithmetic, and perhaps, writing. They felt that these skills were essential to any rudimentary understanding of the concepts of the various disciplines, and seemed much more worried about the child who was not getting the basics than they were about the child who was bored by an overattention to simple tasks.* Some teachers were quick to add, to the definition of what is "basic," their favorite conceptualizations, such as conservation of energy, or human need to communicate. They were seldom rebuffed by others for "corrupting the movement"--but it was clear that more people wanted less teaching of the concepts and more teaching of the facts.

There was very little attention to test score results as such. Most of the teachers expressed little interest in or confidence in such data other than to tell them what they already knew. They were certain that students by and large are not sufficiently accomplished in the elementary learnings in their subject matter and other areas of study, and that the curriculum change should be mandated to improve that situation.

There was rather little interest in the question of how children as a whole, or individual children, think. Teachers did not see it as important to their jobs to find the unique obstacles to learning that might be blocking an individual learner. There seemed to be a conviction that failing to learn was more a failure to mobilize than a failure to fit new ideas into old experience. It wasn't that a child was marching to a different drummer but that he wasn't paying attention or just didn't have a sense yet of what marching is.

They did not see teachers as needing help in creating something, but occasionally needing help in dealing with the obstacles to learning: inadequate teaching materials, unwilling learners, an unsupportive public. They saw "Staff Development" as capable of being stimulative and providing a good opportunity for teachers to think about what they are teaching--but not often dealing with the real problems of teaching. They felt surely that they and all their colleagues could provide first-rate education if you gave them smaller classes, the text and demonstration materials they needed, and a decrease in the administrative obligations imposed on each classroom teacher.

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*They seemed more concerned that the recalcitrant learner would get in the way of class progress than that he/she would end up uneducated. Emphasis on "basics" to some was a way of re-establishing "tracking."

The site visit team came away with a surprisingly uniform picture from teachers, students, parents and administrators. They had their separate worries, to be sure. But they saw themselves in a serious, not very exciting business; the business of education. They saw themselves as pretty good businessmen, wishing that times would change for the better, but confident that they could deliver on their promises and pretty well satisfied that there is not really a better way to run the shop.

Robert E. Stake

REPORT #2

1. I would have liked to have heard reactions to a somewhat more substantive scenario, such as #6b, in preference to the looser ones that were used.

2. I was struck by the categorical statements made by the high school girls we met, concerning an altered social attitude toward girls in science. I do not take this as meaning that the problem has been eliminated (I am sure one would find different attitudes in other places and among other girls in the same school), but I found their explicit statements profoundly encouraging and indicative of shifting attitudes.

3. I was disappointed by how frequently the conversation with teachers drifted into the eternal old complaints that have been hashed over ad nauseum. I felt that team members did very well to return the discussion to a more fruitful track when it did drift, but it was clearly difficult to keep it substantive.

4. NSF, in its current guidelines, is putting tremendous emphasis on evaluation within projects. (I realize this is being done under the congressional whip.) The more I look back over the past 20 years, however, the more I am led to question the importance of evaluations conducted during and immediately after the project and the more I become interested in evaluations conducted in subsequent years, after the initial novel[illegible] been worn off. Are the results of the project still viable and in use? [illegible] thing softly and silently vanished away? If so, why? Did the project re[illegible] other (e.g. commercial) operations? If so, how and to what extent? I sug[illegible] be urged to undertake some examinations of this kind rather than confining evaluations to recent events in which the so-called "Hawthorne Effect" is still likely to be a seriously confounding factor.

5. I noted that the teachers we talked with (particularly in the elementary and junior high) seemed not at all sensitive to the fact that competent and effective implementation of the better inquiry-oriented science and social science curricula might have the potential of significantly upgrading both the language skills (reading facility and reading comprehension as well as speaking facility) and arithmetical skills of the children. Teachers who have developed some genuine competence in the handling of such materials are, in my experience, far more sensitive to the impact of such curricula on the basic skills of the children, and they are then more ready to regard science and social science as having a place in the "back to basics" formula.

6. I note that we did not flush out any evidence of external pressure against the reading and discussion of "controversial" subjects. My guess is that this results from a combination of two effects: the choice of materials in the schools was relatively conservative; the community does not seem to have a self-reinforcing nucleus of vocal rightists. (In another area nearby there was a sizable uproar last year about the MACOS course at about the same time Congressman Conlan was objecting to it in Washington.

7. My own personal recommendation to NSF for the future: much less emphasis on new curricula and a major push in two directions: (1) increase the competence and security of presently active teachers in handling the improved curricular materials that now exist (quicky work-shops and vague discussions of "philosophy" of the program will not do; they must develop command of the subject matter): (2) improve what is going on in the universities so that newly graduated teachers are in command of the substantive content of the new curricula and are not in need of remediation at the instant they graduate. (N.B. Both activities require serious implementation of the best current knowledge concerning psychology of learning and theory of intellectual development.)

Arnold B. Arons

REPORT #3

Introduction

This site visit report is divided into two major sections. The first section contains eight numbered paragraphs. Each paragraph begins with a finding which, based upon my observations at the site, I believe has a high probability of being true. Using these findings as premises, I inferentially develop the remainder of the paragraph drawing conclusions about which I feel less certain. Finally, where appropriate, I conclude each paragraph with evaluative judgments or recommendations.

The second section presents a more holistic and integrated view of science education at the site. Rather than repeating the findings from part I, I try to describe science education within the context in which it is found. This is a more general task and leads me to make statements which are more evaluative than descriptive. Taken together, I believe the two parts provide an accurate representation of the site.

Part I: Findings

1. There is absolutely no articulation between the three major grade units (K-6, 7-9, 10-12) and very little articulation between classes within a unit. The major exception is K-6 math which uses a fairly new district wide program. It has a significant amount of structure and standardized testing. Given the difficulties surrounding articulation, this finding is not really surprising. What is a bit surprising is the strong desire expressed by teachers at all levels for articulation. This, especially in the absence of any actions taken to more fully articulate the various programs.

Various hypotheses (neither mutually exclusive nor jointly exhaustive) can be postulated in an attempt to explain this desire: (1) teachers would like to know what they can legitimately expect from students entering their classes; (2) teachers have a great sense of the ad hoc, a feeling that maybe they're not teaching the right material, an insecurity--they need some kind of curricular floor to act as a psychic net; (3) the constant reshuffling of teachers given fiscal cutbacks makes the job of teaching that much tougher and this constant new exposure to new environments could be softened if there were district-wide (one teacher even advocated nation wide) standards.

I believe that given the individual nature of education (students, teachers, communities) it is better to err on the side of less articulation than to force individuals into a prescribed structure. Therefore, I am not particularly worried about what the faculty perceives as a lack of articulation, especially since it is occurring where it is most needed (K-6 math). The problem is important only to the extent that it is a psychic burden on the faculty. Nevertheless, I do believe that there should be more communication between teachers of the three basic units as well as inter and intra departmentally.

2. The treatment of science on the K-6 level is really nothing more than show and tell. This school district has had monetary cutbacks which have shortened the school day. Most of this day is spent with reading, writing, spelling, and arithmetic. Although the students really enjoy science, it can only be fitted in two or three times a week. There is no money for prepackaged materials so the teacher's preparation time for science is greatly increased which correspondingly diminishes the variety of lessons available. The teachers endorse a sequenced approach to science similar to the math program.

I believe that the above described program is presenting the absolute minimum (if that) amount of science that is acceptable. Aside from the obvious problems of time and money, I feel the whole effort is suffering from a lack of rationale. Why teach science to children? What should we expect a third-grade child to know about science?

3. The district-wide teaching of science is being squeezed between a perceived need for both the basics and vocational education. Science is being depreciated. Almost everyone I spoke with thought that the basics (3R's) came first and that science was not included in the basics. The elementary school teachers even noted that a survey of parents was conducted and that the basics were overwhelmingly rated as the number one priority. On the high school level getting a job is a high priority. The most direct route to this end is vocational education. Science is not perceived as resulting in cashable skills except if one is to be a professional scientist. This, of course, leads to an elitist view of science.

In the jargon of the 60s, science is not being perceived by the students as relevant. One solution being tried in this district is the offering of directly relevant courses (e.g., plant indentification, horticulture). But this misses the point. If science is ever to move from an elitist position, we must demonstrate how science affects our lives across many dimensions (e.g., public policy, factually, methodologically, and conceptually).

4. While the science department is not destitute for funds, its monetary resources continue to be cut back. The department has no budget for equipment. Its expendable supplies budget was cut last year by 25%. Courses previously offered have been dropped and one biology teacher says that she does not have enough books to go around. Despite all this, the program is generally strong. The query I want to raise is this, at what point do the cutbacks result in a qualitative loss in the program? Alternatively, how much additional money would be needed to significantly raise the quality of the program?

5. Everyone agreed that the most important parts of the learning equation are the teacher and student. The curricula materials are secondary. What seems most important is attitude. Students didn't talk about how much or little their teachers know. They talked about how teachers related to students. Faculty didn't talk about IQ points or student's ability, they talked about student attitude and desire to learn. On this latter point the faculty were generally derisive. There was a feeling that students didn't care as much about learning as in the past and this was attributed to outside interests, more students holding jobs, and a general decline in discipline. The only comment about curricula was that the core curricula were fine but that enrichment courses relating science directly to the world would be useful. The only exception to this is the basic math course which seems to be in need of total revision.

6. The average age of the faculty continues to rise and no new teachers (those entering directly from college) are added to the faculty. This same problem is happening on university campuses with the same effects: (1) how can you keep teachers knowledgeable about current trends in both subject matter and learning theory?; (2) how can you keep teachers revitalized?; (3) older faculty are most resist nt to change. An example of this last point is resistance to the hand-held calculator. The teachers in the primary grades could not even conceive of allowing hand held calculators in their class rooms.

7. The number of women in the high school science and math classes is about 50%. This figure is only meaningful when viewed from the perspective of a trend. However, in absolute terms, I would think that the 50% figure is quite desirable. No one I spoke with seemed to

have a simple explanation of this but the role of the counselor was played down. The students didn't think the counselors were of much help in anything. The best explanation seems to be the general societal trend and the belief that women can now find jobs in science.

8. There is a great difference between the student's perceptions of classes in mathematics and those in science. A general comment about math classes were that they were dull. Science was perceived as being more fun although the point made in #3 about relevance should not be overlooked. I got the impression many students looked forward to science (at least biology and the electives) but no one seemed to look forward to math. This relates to the point made in #5 regarding the importance of teachers. The math teachers seemed dull to me. One gets the impression it's just a job and they would rather be somewhere else. The science teachers here are a much more lively bunch who seem genuinely involved in their work and spend a lot of extra hours at it.

Must math be dull? Of course not, but one must admit that the science teacher has an easier subject to enliven. How can such a stodgy department be rejuvenated, given the hiring problems?

Part II: Summary

Looking back over my eight findings, I discover that they are almost all essentially negative. This should not be surprising given the negative epistemology of us evaluators. The most important point, however, is that this is a good science program--not great, but good. The teachers are competent and, for the most part, interested. The students are not in need of material well being. There is a good supply of equipment. The courses are current and there is a good selection.

The findings I discuss could probably be made about the English department or art department. They are not problems inherent in science education. They are problems inherent in all of education. I don't believe that this was always the case. Twenty years ago the NSF made a convincing case that science education was lacking both good curricular materials and knowledgeable teachers. Due in large part to its efforts, these problems have been greatly ameliorated.

This is not to say that there aren't any problems unique to science education. For example: intelligent use of the hand held calculator, the higher costs associated with lab related sciences, the dual mission of teaching for both a scientifically literate population and training future scientists, and the potential problems of value laden subject matter in the social sciences. But I believe that these problems are neither of the magnitude of those expressed in the findings nor are they amenable to federal solutions. If one were to ask if there were still a role for the NSF in science education the answer would have to be-- No, not at this site.

Howard Levine

REPORT #4

Regarding Site Visit Purposes

1. New issues in science education.

The basic issues affecting science curriculum at this site were administrative and economic. The teachers were faced with changes in curriculum requirements that directly affected science offerings yet seemed to have very little input in decision-making procedures on a district level. The science requirements throughout the district had been reduced, ostensibly, as a reflection of a school board philosophy allowing students to choose their own classes (especially at the high school level).

There also seemed to be an increasing concern on the part of parents and students with the vocational value of science. Upper-level mathematics, chemistry, physics, etc. were not viewed as directly related to job skills.

District and community priorities have shifted away from science and toward social problems over the last ten years. This is, in part, a reflection of the question of the transfer (through bussing) of minority students and staff.

An effect of transfers is an increased number of "slower" students. They do not fare well in regular classes. Special programs for these students in science are very limited. Science very quickly becomes a subject for the elite student and is feared by others.

Another administrative problem is economic. Teachers are laid off and/or transferred depending on levy successes. The result is reduced staff and unstable programs that must be reorganized constantly. There is noticeable resentment on the part of some minority teachers and some older teachers who have been reassigned new subjects.

2. Field observations.

Comments will be withheld until review of case study draft.

3. Refine the scenarios.

In my opinion the scenarios are too limited in their focus. They do not inspire much discussion because they are simplistic. For example Scenario C, which was used in all three of my sessions (bad luck, I guess) is very limited. Scenario 3 is much better. I think the scenarios should now be rewritten to incorporate the problems cited by the teachers: 1) educational priorities, 2) curriculum requirements, 3) money for textbooks, 4) unstable staffing, and 5) vocational interests. I feel open discussion around these issues would be more successful than the more stilted discussion resulting from fixed scenarios.

CSSE Project Questions

1. What is the status of precollege science teaching?

Over the last ten years there has been a definite drop in the importance of science courses (primarily upper-level mathematics, chemistry, physics, etc., rather than social science). This is reflected in the priorities of the community, parents, students, and in the curriculum requirements set by the school board.

The result is less money for books and equipment, less enrollment, and less staff. New courses tend to appeal to creative interest (horticulture, edible plants, oceanography) rather than academic science (physics, chemistry, calculus). This is also a reflection of the shift away from precollege towards preoccupation priorities.

At the same time there has been an increase in interest in social science courses, particularly those that deal with cultural and social problems. This may also be a reflection of the changes in HEW guidelines.

The change in priorities is illustrated not only by the school district's actions but also by the fact that the district science adviser appears to have no significant impact on curriculum development.

2. Conceptualizations of science held by teachers and learners.

There is a split here between the practical and the abstract. Traditional (older) teachers maintain a basics approach, teaching concepts with minimal concern for content, although aware of the importance of teaching methods. Newer teachers show an interest in "creative science," especially in areas in which they have particular training or interest. None of the teachers is happy with the current priorities limiting science, and more than one noted "we need another Sputnik." All of the teachers made a concerted effort to continue their education and seemed up to date in both content and methods.

3. What happenings in school and community are affecting the science curriculum?

As noted before, the social upheavals of the sixties have clearly replaced the science war of the fifties. The community seems more concerned with social relations and personal security (economic and psychological) than the advancement of science. The priority is not to beat the Soviet Union in technology but instead to survive as a viable society.

Jennifer James

REPORT #5

Science is perceived differently in its 3-4 brances. In biology, there is a serious attempt at a pupil-related program. Special courses for gifted and slow learners have been replaced by a system of 3 levels of lab guides, which guide the student through Biology 1 and 2. The level is chosen by the student but recommendations are made on the basis of a BSCS general test. Horticulture is available through the vocational department plus environmental sciences.

In chemistry and physics there is much less choice: A standard curriculum of general organic chemistry is accompanied by a standard Physics course. The limited perceptions of flexibility and applicability in chemistry and physics is obvious.

In athematics, there are essentially two tracks. Algebra, geometry, trigonometry, Coordinate geometry, and calculus constitute the academic track, and general mathematics courses provide practical computation training for the non-college bound students.

In the Social Sciences, however, there is much less division between different tracks and also a fairly wide variety: civics, history, psychology and sociology.

Methodologically, the GREATER SEATTLE site visit raised some interesting problems:

1. The three scientists each were accustomed to a certain style of social science (James - ethnographic participant observations, interviews, etc.; Arons - cognitive interviews; and Levine - evaluation strategies). While this is atypical, other sites may experience a similar conflict between preferred methodologies of site visitors and the expected style of the site visit.

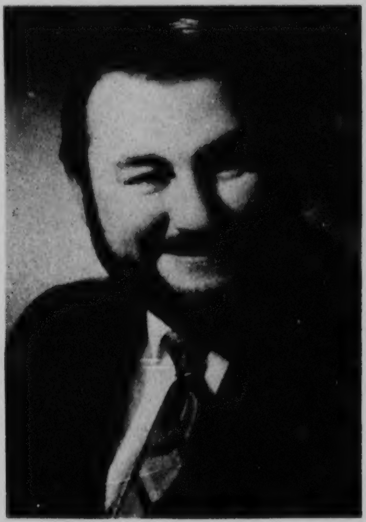
2. While coverage was a goal, efficiency of the work in terms of utilization of observers was not optimum because, primarily, of the difficulty of finding time for teachers and others to be interviewed. Wednesday was the worst day, because time scheduled for writing reports was not so used. No one wanted to write before completing their sessions. The talk on Tuesday, waiting for any visitors who might have come, was valuable as consultation, but might have been planned as such with an agenda.

3. It was difficult to evaluate or revise the scenarios used in interviews because so little reference was made to them. What there was was extremely general. No site visitors suggested they were useless as stimuli--however, it was far from clear how they might function in a mail survey.

4. In the initial meeting with the field observer, an impression of a rather outstanding science department was conveyed. However, by the end, the tendency was to limit that rating to the well-developed extra set of options in environmental science. The staff-developed multi-level biology workbook seemed to provoke a lot more textbook searching than it did observation of planaria in the one lab session that was visited. Students were docile; there was no great show of interest. Possibly, there are other more outstanding features, which were not seen by the site visitors. To the extent that quality breeds contentment, these seemed to be an impression conveyed by the observer. Money for supplies was clearly one issue. Were there any others?

I think NSF could help with the support of science courses that would relate to students, e.g., materials science, more interesting mathematics, ethnography of Western Societies; how history of art, technology, law enforcement, family life, music, and science relate; war and peace and their causes. History of the Northwest, Southwest, Southeast, Northeast sections of the country; how to read a newspaper, etc. But I am dubious about the value of textbooks. Because of the budget crunch they're mostly used as references. Pamphlets and lab materials would be valuable, if cheaply produced, or bound in plastics for longer survival. Handbooks of reference material could be useful, even encyclopedias of science topics at a high school level, e.g., Science Yearbook published by World Book. Perhaps all that's needed is a cummulative index to their volumes. (The science establishment is otherwise very little in evidence.) Science appreciation and math appreciation courses are needed for teachers and "turned-off" pupils.

John A. Easley, Jr.



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Wayne Welch has been associated with nearly two dozen evaluation projects since 1965, either as director or as consultant. He is a past president of the National Association for Research in Science Teaching and has also held offices in the American Educational Research Association, the American Association for the Advancement of Science, and the National Science Teachers Association. He has been listed in _**Who's Who in America**_ *(1974, 1976),* _American Men and Women of Science_ *(1972),* _Educational Leaders_ *(fourth edition), and* _International Men of Science_*. The author of numerous funded proposals, Wayne has also written articles published in such journals as the* _Journal of Research in Science Teaching_*,* _Science Education_*,* and Phi Delta Kappan. He is the author of the chapter "Evaluation for Decision in Integrated Science" in New Trends in Integrated Science Teaching, volume four of Evaluation in Science Teaching, published by UNESCO.

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Chapter 6

CASE STUDIES IN SCIENCE EDUCATION:

PINE CITY

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August 1977

6

Pine City is located in the "heart of Dixie," not far from the capital of the Confederacy. Brown vs. Topeka Board of Education (1954) has had an enormous impact on this community and its schools. "In the eyes of everyone in Pecan County," writes the observer, "integration is the key issue, perhaps particularly in the schools; but much of what is focused on education pervades the community as a whole."

The importance of leadership is clearly evident in this setting. The current superintendent spearheads a valiant effort to upgrade education and to restore a sense of community pride in and respect for public schooling. He is white; the assistant principal in the high school, an older black man, remains a pillar of stability over time. A local minister joins in their efforts from his pulpit; teachers contribute by providing myriad examples of social interaction across racial lines.

Finances are an overriding issue. Schools in the rural South possess a long history of underfunding. For generations the region supported a dual system; today, the white academies are symbolic in part of a deep-seated reluctance to finance an educational system for all the children and youth of the community. Descriptions concerning the lack of equipment in science classrooms, the constraints thereby imposed on both teachers and students, are stressed by the author.

Teachers are faced with an unrelenting need to emphasize mastery of basic English: labeling, defining, recall are common to all classes. The "learning lab," where a working knowledge of science becomes important, is found in the vocational realm, especially auto mechanics.

> *Before total integration, we already had whites going to the area [trade] school. The first two years, Mr. T. [former superintendent] decided we'd use this to give the blacks somewhat of an advantage, but the whites decided they had just as much right, too. . . . So two years before we had total integration, we started busing white students into the area trade school, when it was still an all-black school.*
>
> *Now a good mechanic, if he's a crackerjack, it doesn't matter what color his skin is. Our two top boys from automotive were hired. One was a black and one was a white.*

There is hope in Pine City and it is reflected in the observer's comments. Much work lies ahead, and the past has not been a pleasant one; but the promise of the "New South" is examined in these pages.

I've always admired those reporters who can descend on an area, talk to key people, ask key questions, take samplings of opinions, and then set them down in an orderly report very like a road map. I envy this technique and at the same time I do not trust it as a mirror of reality. I feel that there are too many realities. What I get down here is true until someone else passes that way and rearranges the world in his own style.

John Steinbeck
Travels with Charley, p. 69
Viking Press 1961

ACKNOWLEDGEMENT

Many people in Pine City were generous with their time and interest, and each contributed to this study in some way. It would take several pages to list all the people who helped us, not only in the school system, but also in the community.

It seems unfair to single out individuals, but Ben Walker thanks his kindergarten class and their teacher, all of whom he remembers with great affection. And as a family we would like to take this opportunity to thank Rachel, for she was tireless in introducing us to new places, new things and new people. Without Rachel's help this study would have been much poorer.

CASE STUDIES IN SCIENCE EDUCATION:
PINE CITY

Rob Walker

BACKGROUND

The Schools

The public school system in Pecan County includes Pine City Kindergarten, Elementary and High Schools, which together form the subject of this study. In addition, the County School Board administers the schools in Greensboro and Magnolia which are not included in the study. The superintendent, who is appointed rather than elected, does, however, have responsibility for all public schools in the county.

Enrollment in Pecan County public schools in September 1976 was as follows:

	Grade	%white	%black	Total
Pine City Kindergarten	K	38	62	236
Pine City Primary	1-3	34	66	618
Pine City Elementary	4-6	38	62	645
Pine City Junior High	7-8	37	63	500
Pine City High School	8-12	38	62	913
Magnolia School	K-12	68	32	533
Greensboro High School	1-3, 9-12	43	57	525
Greensboro Middle School	K, 4-8	42	58	429

The ratio of black to white teachers in the county is about 4:6.

Characteristics of the Area

Pine City is a town of some nine thousand inhabitants in a rural part of the Deep South. In each of the last two decades the population of the city itself has grown by about one thousand, though the overall county population has remained more stable. In the past, the prosperity of the town has been linked to the railroad, which still runs through the center of town; but in the last few years its economy has been largely sustained by the interstate highway which passes just inside city limits. Economic growth has been gradual, but unlike many similar towns in the region, the presence of the interstate highway seems to have prevented recession or decline.

Seen from within the community, the shift in focus from the railroad to the highway has meant change. The new shopping plaza out near the highway exit has not yet resulted in the decay of the main street shopping area, as it has in some towns; but it has displaced the pattern of life, and seems to be an important symbol for the city. The supermarket, discount store, motels and fast food facilities bring revenue in, but they are also an outpost in the mainstream of American culture, a bridge to the outside world and perhaps to the future.

The area surrounding Pine City is densely forested and thinly populated. Where there is open land it is mainly used for grazing beef cattle. At the turn of the century, however, cotton plantations still dominated the local economy, a legacy which remains in the fine ante-bellum houses still to be found in the area, and, some say, in local attitudes and the local political process. Sharp differences and divisions between the lives of black and white, the wealthy and the poor, the powerful and the powerless, might be less marked than in the past, but they remain salient features of the community.

The area is predominantly rural. Pine City children fill only about 25% of the places in the public schools; the majority are bused in from the country. Fifteen years ago the area was dotted with small country schools, and many older people can remember when schools were only open for the four months or so children were not needed to work the land. In those days the system seems to have been more decentralized. Administrators in the office did not always know too much what was happening out in the country. When the country schools were closed, one administrator remembers, it was estimated about 400 children would emerge from the woods to fill places in city schools. When they did close the schools, more than 800 appeared. . . .

Now the school board operates a fleet of fifty-four buses, some children travelling twenty miles to school each morning. Typically these children come from the small farms which scatter the landscape. Despite a high degree of self sufficiency, this is an area where people are mostly poor. About 80% of the children attending Pine City public schools receive free lunches.

Some children in the town attend private schools; there are two all-white schools in Pine City with a combined enrollment of some 500 students (K-12). Others travel out of town to one of the two or three other private schools within easy reach. Pine City also has a small white church school (reputedly with a heavy emphasis on programmed learning), and a long-established black junior college.

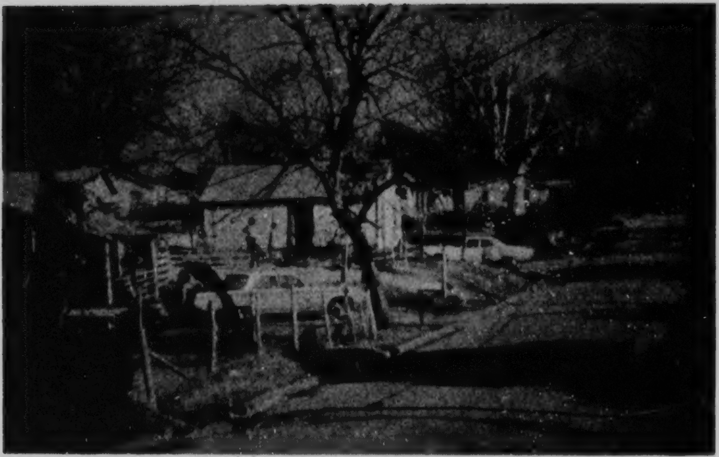
It is difficult to find out the proportion of children attending private schools. The estimates people gave me fell mainly in the range of 20-30%. What can be said with some confidence is that the numbers of students leaving public schools for the private academies has declined recently, and there is even some movement of students back into the public schools from the academies. Enrollment figures in the public schools show consistent increases over the past three years despite a declining birth rate and relatively stable overall population figures.

The Desegregation of Pine City Schools

Through 1968 and 1969, Pine City schools were voluntarily desegregated under the state policy of "freedom of choice." One or two white teachers taught in black schools and black teachers began to teach in the white schools. A few black students enrolled at what had previously been all-white schools, but overall the actual changes were small in proportion to the anxiety that was generated. Even these small concessions fired debate and controversy; and many people, black and white, feared what the immediate future would hold. To many outsiders, integration did not seem to have proceeded fast enough, and in 1968 the situation in the town precipitated a federal court hearing.

Mr. Collins, the superintendent at the time, had been in office for twelve years and in this time had established himself in a position of some power. Although the school board was strongly against integration, Mr. Collins had foreseen the day when it would become mandatory. In consultation with his staff, he had drawn up contingency plans for desegregating the city schools and awaited events before presenting them to the school board. No one knew what his chances of success were, but his personal position was a strong one and it seemed that he might be able to convince school board members that it was better to implement the plan than to face outside intervention under a court order. In any event, he never got to present his case, for during 1968 he suffered a heart attack and died. One of his former colleagues pointed out that this was not an uncommon fate of school superintendents at the time, faced with both outside pressures and local hostility.

Mr. Allen took over as superintendent; but, being new to the job and lacking Mr. Collins' authority, he was unable to get the plan that Mr. Collins had worked out accepted by the school board. In his position he may well have been unwilling to confront the board on fundamental issues, and may have lacked the detailed knowledge necessary to persuade or out-manoeuver them. Instead, a scheme was evolved--under pressure from a federal court order and with professional advice from one of the new state universities. This plan, implemented in 1970, involved extensive busing of students between the different school sites in Pine City (see Figure 1).



Though this plan was implemented in 1970, it was considered an administrative nightmare. It was expensive to operate. It alienated both students and teachers without resolving community concerns. Students were seen roaming the downtown area during school hours. Rumors of riots and sexual misbehaviour ran rife through the extensive social networks that characterize small towns. The administration seems to have felt that the plan adopted by the school board was impractical and had been inadequately considered. Privately they suspected certain school board members of being near the center of the rumor mill. It was said that school board members even were recruiting students for the private academies.

Present name:	In the 1960s it was:	In 1970:	Since 1971:
Pine City Kindergarten	Black Elementary Grades 1-6	Fourth Grade	Kindergarten
Pine City Primary	White Elementary Grades 1-6	Grades 1-3	Grades 1-3
Pine City Elementary	White High School Grades 9-12	North Campus Grades 10-12	Grades 4-6
Pine City Junior High	White JHS Grades 7-8	Grades 8-9	Grades 7-8
Pine City High School	a. Black Training School b. Black Elementary 1-8 c. Black High School	South Campus plus ROTC and vocational school	Grades 9-12

Figure 1. Changes in the Use of Buildings Under Various Integration Plans

One private school opened in the late sixties (Fort Smith Academy). The founders were mainly lawyers, doctors and business people. One former high school student wryly comments, "They were people who wanted to keep their children away from most other white children just as much as they wanted to keep them away from blacks." Mr. Collins, architect of the original desegregation plan, did little to discourage the founding of this school and another similar school elsewhere in the county, seeing them as a means for containing the kind of dissatisfied parents who might be difficult to contain in a fully desegregated public school system. Like other private schools in the region, Fort Smith Academy quickly filled its rolls. The events of 1970 increased further the demand for private schooling. Next came the founding of Pine City Academy.

Perhaps more than any other single event, the founding of Pine City Academy hurt the pride of the public schools. Not just because yet more students opted out of the public school system, but because this time they tended to be from middle-income, white families, and in particular from parents who were teachers in the public schools. Worse still, the Academy was largely founded on the initiative of teachers, and even two curriculum supervisors, dissatisfied with the way the public schools were being run.

Although it was white families who actually put segregationist pressure on the public school system, many black families were equally beset by anxiety. They, after all, had as much to lose from a faltering education system. But, as one black woman resignedly put it, "No one was listening to us."

It may be hard to imagine what this loss of confidence meant in a small rural town like Pine City. For some it was devastating. The city had always felt great pride in its football team; and immediately prior to desegregation, the community had given it considerable support; "We had a marching band with 250 instrumentalists," one contemporary remembered. But after the events of 1970 there would only be "about half a dozen spectators at the game, and they would have come in the buses with the team, and the band would be ten kids, and maybe three who could play." In a small town in the rural South, it is difficult to imagine a greater catastrophe befalling the community. Nineteen-seventy is still remembered as the "bad year;" the year when the system reached its nadir.

The following year membership of the school board changed; some of the old hardline conservatives were replaced by younger members, and they promptly appointed a new superintendent (Dr. Williams). Faced by the failure of a court-directed desegregation plan, the new administration invited in consultants from another state university.

The consultants agreed that the current plan was ill-conceived and asked if anyone had any alternatives to suggest. It was then that Chris Taylor, the vocational supervisor and a long-standing member of the administration, who had worked with Mr. Collins on the original scheme, suggested that it be resurrected. Essentially that happened. In 1971 a new desegregation plan was implemented, the overall structure of which remains unchanged in 1976.

In 1973, Mr. Tyson, the present superintendent, was appointed. Since then things seem to have run more smoothly than anyone had expected. The last segregated junior high school class has now graduated from high school. The rumors of breakdown in the schools appear to have stopped, or at least to have lost their force. The growth of the private academies has been checked; middle class white students seem to be finding their way back into the public school system.

To the outside visitor it begins to look like a success story. The schools seem to be working smoothly and integration appears to be accepted. Even those who don't like it seem prepared to accept that the process is irreversible and that they will have to learn to live with it. It is still probably true that "given their druthers" 50-70% of blacks and 70-90% of whites would still feel most secure if their children were in "their own schools." But more realize there is no going back and are prepared to live with the system. As one black high school senior put it: "It doesn't matter much to me whether I am being taught in a class with white kids, or whether I'm being taught with black kids, just so long as I'm being taught."

This may seem to the staunch integrationist a poor epitaph for the brave days of Civil Rights, but in the context of the rural South it is giant leap for mankind. And generally it perhaps gives more hope for optimism about the human condition than Neil Armstrong's perpetual footprint.

Context of the Concern -
The School System as a Social Laboratory

In the eyes of everyone in Pecan County, integration is the key issue, perhaps particularly in the schools; but anything tied to education pervades the community as a whole. Sometimes it seems as though the schools, and the high school especially, are a laboratory for the community, for it is there that social problems are brought to scrutiny. Some people feel that if integration fails in the schools, few aspects of people's lives would escape the impact of that failure.

One consequence of the mood of successful social experiment in the schools is to make the schools look and feel important. In other parts of the country people may question the relevance of schools as institutions, and ask them to justify themselves. In Pecan County there are people who may question the relevance of some parts of the curriculum, but no one seems to question the schools themselves.

It is not hard to detect this feeling of the schools' running ahead of the community in desegregation, even though the clues are often apparently trivial. They are seen more clearly on social than academic occasions. For instance, a year ago the high school scheduled the first dance to be open to both black and white students. Although the principal had been hesitant about allowing it to take place and ominous rumors ran through the town prior to the event, it proved to be an evening of innocent pleasure. Apparently stimulated by the students' success, the faculty this year organized their own party. It was a friendly, if somewhat formal affair, but it developed into a square dance in the gym, perhaps a third of the guests staying on. Next day the various stories circulated the town. There's no knowing for sure, but it seemed the white girls on the faculty quite enjoyed the scandal of dancing with blacks. And some of the black teachers were apparently amused at the incredulity of soul brothers out of school ("square dancing!").

Another aspect spotlighted by the faculty party: some of the women whose husbands were not in education were being carried along by the process of integration ahead of the "head of the family." This was especially true of those whose children attended white academies. One such teacher admitted to me that she had been surprised to see her husband join a square dance set which included a black couple.

Such detail may seem trivial to an outsider in the face of the real inequities that exist in terms of income, employment, health and housing. Yet despite the reality and permanence of the inequities, a trend in attitude is clearly apparent. The school is running ahead of the community, and it seems on balance to be carrying people with it rather than leaving them behind. (I am reminded of Samuel Stouffer's classic study of desegregation in military combat units during World War II. He found that opposition to desegregation came mostly from people not directly affected by it. He wrote: "The further they are from accomplished fact, the more they disliked it." Pretty much the same seems true of life in Pine City.)

By all accounts those close to the fact have had to learn to live with dramatic changes in the circumstances of their lives. One teacher, now in her thirties, told me how during her childhood on a cotton farm her father had made her shut herself up in the house when the workers went out to work in the fields each morning, and again when they returned. For her the blacks were a close yet strange society which she only saw in glimpses. Yet with desegregation she found herself teaching black students and working with black teachers. She confessed it took some time to learn to listen and to talk to the students; and like several other white teachers, she confessed it was only the tolerance and patience of some of the black teachers that enabled her to adapt to the new circumstances.

The process of adaptation may still be active. The gaps in communication are less marked than they once were, but spaces still exist between words. One teacher articulated the point clearly when she said, "You know I talk to Miss Hall [a black teacher] every day. We work together. But I never really know what she is thinking." The cordiality and hospitality that remain characteristic of social behavior in the rural South retain a degree of ambiguity that allows people to retreat behind custom and habit.

For those pressing more directly for integration, there are still significant barriers. Banking, medicine, pharmacy and the law are still exclusively white, as are most public offices. Yet there is a feeling amongst those in leadership positions in the school system that these are protected more by the expense and exclusivity of higher education than by the local custom.

A mood of optimism, almost of crusade, seems to be what holds the school system together and sets its tempo. Paradoxically, even those teachers who do not share the conviction of the integrationists seem carried along by it, almost despite themselves. I found it quite common for white teachers, who seemed to give no hint of prejudice in school, to return to the conventional racial prejudices and stereotypes out of school, albeit in muted and oblique form. It seemed to me at times that those who were making integration work in school, out of school found themselves puzzled by their own motives. Many of the teachers ran small farms in their spare time, an occupation which provided little financial reward but which, like hunting and fishing, provided an opportunity for solitude and escape. It would be stretching the point to explain this entirely in terms of a search for a return to older values and a previous way of life, but at times there did seem to be an element of this about it.

I confessed to one black girl that I didn't know how to react when teachers, who in school seemed intent on making integration work, out of school expressed prejudice. Should I admire their professionalism or condemn their hypocrisy? She admitted it was often confusing for black students:

> *There are teachers who will be real nice to you in school, but then you'll meet them in town walking along the street, and because they have their wives or their husbands with them, they'll just act like they don't know you.*

The superintendent is seen by most people as being in a key position on the integration issue. He is generally regarded, by opponents and supporters alike, as the person who is making integration work in the schools. His refusal to provide private schooling for his own sons, and his determination to approach integration positively have made a big impact. "Since he came," one teacher said to me on a number of occasions, "the situation has turned 'round and things have just got better and better." However, the superintendent cannot be seen to let the schools run too far ahead of the community; as he repeated to me several times, "Integration is the dominant issue here--I can truthfully say that I never make a decision of any consequence without considering its effect on integration." His own success is bound up with the commitment to make the system work. In steering a way through public concern and established attitudes, he has had to develop a sensitivity for situations not unlike that previously cultivated by blacks. The anecdote that best captures this concerns the mural painted on the primary school under the direction of an artist-in-residence. It just happened, she explained, the the black children wanted to paint people, while the white children wanted to paint houses, buses, trees and flowers. The result was a colorful landscape, peopled by black figures. The mural is in a prominent position readily visible to visitors to the schools and the school board office, and as it neared completion the superintendent walked across from his office to take a look. "Very colorful," was his pointed comment. Shortly thereafter there were some white faces too, roughly in the proportion they are in the schools (but still with brown bodies). His sensitivity may not be infallible, but it is ever active.

THE CURRICULUM AND THE SCHOOLS

For the past few years the dominant concern has been with the relationship between the school and the community, rather than with more strictly curriculum issues. It is as though the curriculum reforms of the sixties had passed the school by; or to put it more accurately, only now is the school ready to contemplate the kinds of curriculum reform advocated by curriculum developers over the last fifteen years.

There have been curriculum experiments. The junior high school for a while ran a course in aerospace studies, which is now limited to part of a more general course. At least two of the science teachers have had summer training in the "new" curricula (BSCS), but on their return have found it impossible to contemplate implementing it with the limited resources available.

Given the current situation in the schools, it seems unlikely that either of the high school principals would push for greatly increasing the rate of curriculum renewal. Mr. Carter, the junior high school principal, has as his main concern the efficient running of the school and the overall behavior and attitudes of the students. He worries about the high-risk pregnancy cases much more than about increasing the rate of curriculum change. His concern is for the students rather than for the curriculum. Mr. Barnes, the high school principal, too seems increasingly involved with administration: "This job is 90% paperwork. It hasn't always been like that, but it seems now that everything has to be filled in in duplicate and triplicate." Glancing over the pile of mail that had arrived on his desk that morning, he added, "I've just received this [holding up a several page questionnaire], from the State Ethics Committee. Everyone earning over $15,000 a year who holds a position where they have to deal with money and contracts has to fill in one of these detailing their income from salaries, interest, mortgages, stocks and shares, and so on." Mr. Barnes is a mild-mannered, quiet-spoken man, not usually given to taking a radical stance over such things, but he gave the document the nearest he probably ever gets to a severe look and added, half joking at his position: "All things they've got no right to know. I'll think about it, and I may decide not to fill it in!"

On another occasion an interview I had arranged with Mr. Carter was interrputed for fully fifteen minutes while he tried to extricate himself from a telephone conversation with a persistent ball-point pen salesman. "How's the hunting season down there?" the salesman started out, just as though it were a social call. . . .

The building principals are concerned to hold on and consolidate the position they have won on desegregation. The superintendent, though, takes a long-term view and a more direct interest in curriculum issues. It is, for example, through his urging that the county has an artist-in-residence working in the school system, and (for the first time) a full-time art teacher in the high school. He would like to see art and music extended, and after that perhaps the social sciences. . . .

It would be a mistake to over-emphasize the difference in viewpoint between the superintendent and the principals, for the differences seem rational and objective, not personal. I first realised some of the implications of these different ways of looking at the world in discussing the evaluation of teachers, a topic Mr. Tyson, the superintendent, frequently thinks about. Mr. Barnes, the high school principal, told me:

> *Mr. Tyson would like to see us in the classrooms observing the teachers on a regular basis. But I feel I should be close to the office where people can find me if they need help or advice. We've built up a good atmosphere in the school, and I think teachers and students do feel free to come to the office if they have problems, or if they just want to talk. I always try to be available when classes change and during lunch time and break, which means I have to get the administrative things like phone calls done, and seeing visitors and parents during lesson time.*

The students do not all share Mr. Barnes' perception of the accessibility or impartiality of the office, though between the principal and the assistant principal most students feel they can rely on a sympathetic hearing. Mr. Barnes has other ways of keeping his ear to the ground. When a previous science teacher upset students by teaching "too far above their heads," news soon reached him, not only from the counselors, but through the informal social networks that so often add complexity and interest to life in a small community.

Mr. Tyson, the superintendent, feels Mr. Barnes takes the paperwork too seriously. "The principal's job is the curriculum. He should know what is going on in every classroom." Adding, only partly tongue-in-cheek, "everything else can be done at the weekend."

The difference in viewpoint between the superintendent and the principal is an interesting one. The principal sees his job as primarily concerned with immediate events. He feels he has to be at the centre of things in case there is any trouble. He sees himself as a conciliator, and as responsible for containing delicate situations. This perception of his role is certainly in part a legacy from the recent past when everyone feared what dominoes might fall every time a word was said in anger, or a black boy was seen chatting with a white girl.

In the interest of "security," student movement around the school has been reduced and extra-curricular activities have been cut. Clubs only meet briefly once a month, field trips are quite rare and student social activities are planned with great care.

Such attention to administrative detail might seem more like over-reaction than prudence, but the principal had to respond as much to public concern as to the likelihood of real trouble.

Mr. Barnes told me:

> *You've probably noticed that we have two bells between classes. First the girls change class, then the boys. The reason is that these buildings were originally designed for elementary school children, and they just get too congested if all the students move together. We've had student committees try to think of better ways of doing it, but this seems to be the best. But in the town the rumor went round that things were so bad here that we dare not let boys and girls out into the corridor at the same time!*

Mr. Barnes has had reason to develop a fine sensitivity to the potentials of rumor and a strong sense of caution. Some of the students feel he has been overly cautious at times, but the fact that the situation is as stable as it is is certainly due to some extent to his sense of caution, backed up by the assistant principal's experience and authority in the black community.

Principal and assistant principal complement each other in many ways, and if there is a question mark over the school it may well centre around what happens when the assistant principal retires in two years' time.

In contrast to the building principals, the superintendent, Mr. Tyson, prefers to take a longer term view, to adopt a more challenging stance, and perhaps to take risks. He is a strategist rather than a tactician (maybe his background as a football coach is significant). To the cautious he may sometimes seem a dangerous idealist, but his survival in a difficult situation is mostly due to his persuasiveness and his ability to command loyalty from his staff. Somebody commented to me, "He's a great man to work for because he gives you the feeling he trusts you. He's not breathing down your neck all the time." It is an approach to management that has won him respect even from those who do not wholeheartedly agree with his ideas; as someone else told me, "I'm awful glad I work for him and not against him."

In the eyes of his admirers, Mr. Tyson's great strength is that he sees things in terms of people rather than systems or organisations or models or plans. His appointment strategy is to hire people who "look good, sound interesting when they talk, who seem to be good people. If I like the look of them I hire them first and find jobs for them afterwards. You can always find jobs, but finding good people is hard." He likes to quote the football coach: "This is a people business." He does have interesting people, often with unusual career histories. An ex-U.S. Marine who teaches in kindergarten, for example, and a one-time high school home economics teacher working in the first grade Title I program. Choosing interesting people is an important element in his strategy for curriculum change. He likes to give freedom to people who have a sense of vision. It is a style with obvious attractions, but it has its risks. Mr. Tyson puts his judgment of people to the test; he commits himself to the success of those he has sponsored into the sytem, and so becomes vulnerable to their failures . If he intervenes, he knows he risks alienating large sections of the faculty. As yet, no major incidents of this kind have occurred, and if they did he would no doubt survive. Nevertheless, the sense of risk is always present. Those thus sponsored into the system find themselves with remarkable opportunities, but sometimes with a sense of isolation from their colleagues. From the beginning they are marked out as unusual or different and can find themselves in a position of some isolation. When this happens to teachers in a city they can often find alternative kinds of support, perhaps in a nearby university or in some quite different pursuit. In Pine City, however, there is very little else to turn to, especially for the single teacher used to city life. It may mean travelling out of town for the weekend just to find someone neutral and supportive to talk to.

It remains to be seen whether Mr. Tyson's concern with curriculum issues will leave an impact on Pine City. Despite his success in other directions, it is a vision that seems to run counter to all visible trends. Perhaps he will not remain long enough to find out, for some of his colleagues predict he is destined for promotion to a bigger district.

THE TEACHING OF SCIENCE

First Impressions

A glance at the daily schedules and the faculty list shows that science plays an important part in the curriculum of the high schools. Compared to schools in other places the emphasis is not unusual, certainly not startling, and the content of the courses seems orthodox. For the casual visitor to the school, examining the actual curriculum, science plays a lesser role than it does on paper. In junior and senior high school alike, there is only one room equipped as a laboratory. In one school it is only distinguished by a demonstration bench; in the other, by table space for perhaps twelve students to work. There is nothing like purpose-built laboratories or computer terminals. In the time I was in the high school I did not see microscopes, circuit boards or bunsen burners in use (though no doubt some of these things could be found in cupboards).

The one science teaching resource that seems in abundance is the textbook. The books look new and expensive, in marked contrast to the laboratory equipment and the classroom furniture. The libraries have interesting selections of science, and science-related books, and schools receive regular copies of the magazine Current Science.

To the curriculum analyst visiting the schools, the science courses would not appear exceptional, but they are conscientiously taught by popular teachers. Despite the reputation they have for being difficult courses, science and math attract growing numbers of students. The observer would probably notice, though, that for the most part science is taught in classrooms by people who see their role as teachers who happen to teach science, rather than as active members of the scientific community who happen to teach.

The Teachers

The science teachers tend to be in mid-career, but include both young and highly experienced teachers. They seem well-qualified, especially in the life sciences.

Like teachers in other subjects, for the most part the science teachers are natives of Pecan County, or the neighboring counties. Many come from farming backgrounds and still live in homes their parents owned, or on the family farm. They would joke that commuting into Pine City was their one contact with the "big city and the bright lights." "The place I come from," one told me, "people drive into town on a Saturday night just to watch the traffic light change." Living in a rural area isn't something they see as a disadvantage. They have chosen this way of life. One biology teacher summed up his own feelings and doubtless those of several others when he told me, "I've only been out of the county once, when I went to school, and that was enough." (The university he attended was only a two and a half hour drive from home.)

Many teachers live in Pine City itself and a few commute from the state capital, less than an hour's drive on the interstate. My impression was that black teachers tended to be more urban-oriented than white teachers. However, none of the high school science teachers was a city dweller: most were country people.

Another characteristic of the teaching body as a whole is the extensive marital and kinship networks that create the basis of a rich informal communication system. The wives of the superintendent, the high school principal and the junior high school principal all teach in the senior high school, and there are numerous wife-husband teacher pairs, and even two brothers teaching in the same department. More than in other subjects, however, science seems relatively unentangled by such relationships.

A Key Issue: How to Motivate the Students

Motivation and Discipline

Discipline is not a major issue for teachers in the high school. The school shows none of the marks of a faculty under siege from the students. The teachers come into the teachers' lounge at break relaxed and talkative. The corridors and classrooms seem free of the usual signs of vandalism. Between classes students move in groups rather than as masses. The police rarely visit the school, and then only on invitation.

If you ask the teachers about discipline, what they tell you about is the problem of getting students interested in the subject, rather than how to handle confrontation. Those incidents that do arise seem mainly to involve students' talking in class, or at worst, talking back to teachers. The worst discipline incident that occurred while I was at the school concerned a boy who let off a firecracker outside school--an action that cost him five days' suspension from school.

As you walk down the corridors during lessons you don't hear teachers shouting or students clamoring for attention. It is not a common occurrence for students to be paddled. The general atmosphere is one of an efficient, perhaps unquestioning institution, where most people (administrators, faculty and students) seem mostly concerned with getting on with their work.

Most teachers agree that the key problem is motivation. "In every class there are one or two, perhaps sometimes it's more, who just sit there, and whatever you do, however hard you try, it's just really difficult to reach them."

One of the guidance counselors sees the problem as being a general one:

> *Motivation really is the big problem here. I don't understand why it is, but looking at it rationally, students in the Northeast of the United States consistently score higher on tests of academic motivation than students in the South. Yet I am sure our students are just as able.*

Motivation is an issue at the junior high school, too, though here it is more often expressed as a discipline or behavior problem. Where the assistant principal of the senior high school despairs of students' (black and white) failing to capitalise on their abilities and opting for courses below their capabilities, the principal of the junior high school worries more about disorder and changing moral values.

Local perception has it that a particularly difficult year-group is presently going through the system. The teachers say that the current seventh grade has a generally low standard of attainment, lacks a core of highly able students, has more than its share of remedial cases, and is generally immature. The principal worries about a number of the girls who seem to him to be high risk pregnancy cases. He sees this really as a problem beyond the school's control, but worries anyway. In Pine City parents and neighbors often make such things seem the school's responsibility. It's not that teenage pregnancies are any more frequent than they ever were, the principal explains, but he seems at a loss to understand current attitudes toward such things, particularly the lack of guilt, concern, or even foresight that students seem to show.

Against this background I want to look in some detail at the way science is taught. A good place to begin is with general science classes at the high school.

Two General Science Classes

Mrs. Griffin is one of three science teachers in the high school. She has been there six years, having taught for one year in the junior high school. Mrs. Griffin's day is spent teaching general science and practical science.

The first thing you notice about general science is that the classes are larger; twenty-six students are in Mrs. Griffin's class, but it seems more because the room is small and even the desks seem small. (A good few of the students are bigger than me and I have trouble getting into the seat.) At one time classes were even bigger. A math teacher told me: "The administration has gone all out to reduce class size, and they've done a good job. . . ."

There's space for little else in the room besides the students and little to distinguish it as a science room. Up in front of the room there's a small mobile demonstration bench which looks new and unused (Mrs. Griffin explained that the room has no gas and no water). On one wall there is a commercial poster about metric measures, but few clues that this is science. The blackboard still retains the notes from the previous practical science class, about tides and eclipses, and the rotation of the moon around the earth and the earth around the sun.

The grade nine class has just started a new chapter in the textbook, on the atmosphere. Mrs. Griffin explains that they have been writing assignments on this work and that in this lesson she wants to see what they have done. She has them read at length from their work while she goes to a back corner of the room and listens.[1] Between each student's reading she asks questions of the class and elaborates the answers.

The assignments appear to have been done thoroughly. Most of the students are able to answer the questions that Mrs. Griffin poses. Sometimes it takes them a little time and some guessing to work out the answer she wants, but in the end they get there:

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[1] When I asked Mrs. Griffin if this was usual, she said: "In the back of the room I feel close to all the students; at my desk only a few seem to get my attention."

"What happens in the air?" Mrs. *Griffin asks.*

"Precipitation."

"We're not talking about rain."

"Rain."

"We're not talking about rain."

"Air."

"We're not talking about air."

"Weather."

"Right."

Inevitably, given the crowded class and the long periods when most students have nothing to do but listen to another student reading, the attention of some begins to wander. Two boys in front of me flick pencils and a small group of girls periodically break into giggles (at me, I fear). Overall, though, what is surprising is not that a few seem distracted, but that most seem quietly intent on the lesson, following the reader, glancing at the text and taking notes.

Part way through, Mrs. Griffin tries to breathe some life into what is hardly a riveting subject by extending the section on flight, especially referring to Charles Lindbergh:

> *Just before he died he gave a speech in Birmingham . . . Do you know why he nearly didn't win the prize, even though he was the first to cross the Atlantic? That's right, he left before he should have done in order to be sure of being first. He wasn't as interested in the money for the prize as he was in the fame he got for being first. After all, we all remember Charles Lindbergh, but hardly anyone knows the names of those who were also in the race but lost.*

Out of the class Mrs. Griffin has an easy, friendly relationship with students, marked by a gentle sense of humour. It is hard for her to capitalise on this natural informality in a crowded class, but there are moments when the out-of-class Mrs. Griffin surfaces:

> *People sometimes ask, with him being alone all that time flying the airplane, what did he do when he wanted to go the bathroom. It's a good question . . .*

She continues to work at making the text as interesting as she can by emphasizing the human aspects:

> *What was the tragedy in his family? It was quite dramatic. That's right, his son was kidnapped. How long before they found him alive? No. They never did find him alive, and the kidnappers were never caught.*

Comments. Faced with a large class and a somewhat pedestrian text, Mrs. Griffin adopts a teaching style that optimises those elements that raise interest.

First, she goes out of her way to avoid technical vocabulary and always succeeds in presenting the subject in straight-forward English while retaining some regard for precision:

> *There are two kinds of barometers. The aneroid or liquidless barometer and the mercury barometer. What is the difference between them? What's the purpose of any barometer? Does it measure temperature, or pressure, or what? Pressure difference. That's right. The author mentions that one has advantages. Which? The "spring?" Which one is that? The aneroid, right. The aneroid has another advantage over the mercury barometer. Whichever way you turn it you can read it. In junior high school they have a barometer on the wall right outside Mr. Turner's room. Do you remember? The other thing is it doesn't make a mess if it breaks. If you ever see mercury you'll know you don't scoop it up. Any question on that?*

Second, as we have seen, she holds the interest of the class by extending the human aspects of the subject, frequently making references to current events or general interest. Perhaps this was a natural emphasis for Mrs. Griffin to make. It does not mean, however, that she devalued the more purely scientific aspects of the subject. Commenting on the omission from one student's assignment she said: "Another thing we should know is that atmospheric pressure is 14 7/10 pounds per square inch. 14.7 lbs/sq in." She turns to the boy who omitted this from his report:

> *Where's this about supporting a column of mercury 760mm high? Where's that in your report? Scientists agree on this particular point. Why didn't you tell us about this?*

Perhaps one of the hardest ideas for the student to grasp is the notion that air has weight. It is particularly difficult in the absence of experiments or demonstrations, neither of which is practical in the classroom. Mrs. Griffin tries hard, within the limits of the situation, to provide convincing evidence, but in the end has to resort to verbal explanation:

> *There's one thing you can do, in here right now, to show that air has weight. [Ruth is dropping a sheet of paper and watching it float to the floor.] Ruth has one idea. You can also blow on the back of your hand. Try it and see. Feel the air? There's also an experiment that you can do with a balloon. It weighs more with the air than it does with the air out. . . .*

It seemed to me that simply describing such an experiment was unlikely to communicate to the students. Maybe the students understood better than I thought. The final question was the telling one: "When you go to the service station are you actually putting in thirty pounds of air in your tire?" Most of the students had the answer immediately. "No, that's the pressure."

Miss Green teaches chemistry as well as general science. She also teaches physics, but this year there were too few students to constitute a class. This is her first regular teaching job and she has been at the school two years. She describes the problem of teaching general science, and outlines her strategy as follows:

> *In general science classes we have general to basic students. I think the only way to reach them is to teach them something they can relate to, i.e., no abstractions. I have left the book almost entirely in order to teach things they can relate to and enjoy, and I find I get more response and motivation in this way.*

She goes on to explain:

> *These students come from [mostly low income] rural areas and their parents do not encourage or push them. Many will be high school drop-outs. I try to teach them things that will be useful in everyday living even if they do drop out. If they do stay in school, they'll get more factual information as they progress.*

Miss Green clearly has a good relationship with her students. She spends time talking to them out of class and in many ways feels close to them. She shares their background and still lives, on her own, in an isolated part of the country. ("Coming to Pine City each day is coming to the hustle and bustle of the metropolis for me," she joked.) It is not so many years since she was a high school student in one of the county's other schools. Summing up the situation as she sees it, she wrote for me: "I feel that the overall problem is lack of motivation at home, but then this is what we have to cope with."

Thirty students arrive for the general science class, but again there seem more because the room is quite small (the buildings were originally designed for elementary school students). This class, too, is studying the atmosphere, and Miss Green has had them collecting barometric pressures from radio weather broadcasts. They are trying to discover how to predict rain. So far it looks like you get rain when the pressure rises, but the class decides it's hard to tell with just two days and only five sets of readings recorded on the blackboard.

Up in front of the class is a mobile lab bench (which also doesn't work). Miss Green has managed to find a vacuum pump so that she can demonstrate some experiments on air pressure, but as she explains to the class, they tried it yesterday in another class and discovered that one of the valves was faulty, making it difficult to get the experiments to work. In addition, one of the most dramatic of all the demonstrations--the silent alarm clock ringing in a vacuum--had to be aborted because the clock was too big to fit inside the bell jar.

Miss Green's general science class is one where the students seem to ask a lot of questions. Whatever they ask, she always tries to answer, even if they seem off the point. The first question of this lesson is a good example. A boy at the back asks: "Someone in sixth period told me to ask you if you would bend your arms round backwards and clap your hands." Miss Green counters skillfully, accepting the question but declining to demonstrate:

> *"We were discussing being 'double jointed.' You know what that means? Being able to move in funny positions, that's right. Well it happens I can do some of those things--it's not really the bones that are jointed any differently, it's how flexible your ligaments are."*
>
> *"Can sound go through a vacuum?" someone asks.*
>
> *"Well if this pump was working I could do the experiment with the alarm clock and show you, but unfortunately I can't."*

The question seems to be the key form of communication in this class. Not only do students ask questions of the teacher, but she rarely talks for three or four sentences without asking questions of them:

> *"Tell us how an aneroid barometer works," she asks of a boy who uses the term.*
>
> *"It's a vacuum between two plates with a spring." Miss Green repeats and elaborates the answer to the class. "We have another kind of barometer; what's it called?"*
>
> *Someone else answers, "Column of mercury."*
>
> *"What are its disadvantages?"*
>
> *"Poisonous."*
>
> *"Expensive."*

"What is the height of mercury in the tube?" Miss Green asks.

"Thirty inches."

The tone and style of the lesson is conversational rather than rhetorical. Teacher and students do not constantly glance at tne open pages of the textbook. The questions students raise seem to be from thinking about the problem rather than from the multiple-choice test.

Someone asks: "Where does the air in the tube of mercury go?"

Miss Green explains: "It's a vacuum," and she describes how the barometer is made. "I'll be doing this tomorrow and showing you, so you'll see. There's no air in the tube, it's a vacuum."

She continues: "What did we say about mercury?"

"It's heavier than water."

"How much heavier?"

"13.6 times."

Miss Green holds up a small plastic bottle in one hand. "Does this look heavy?"

She passes it to one student after another. No one believes how heavy it is until s/he feels it. Once several people have felt it, she lets them pass it around along with a smaller glass bottle. She warns: "Be careful with it. It's very expensive. Two years ago it cost $110 for five pounds, and it'll be more now."

"How much is there there?" someone asks.

"Well, the small bottle is a fourth of a pound; you'll have to guess how much the big one is."

"You must be careful not to drop it because it is highly poisonous and if you drop it we'll lose it. And if you have any gold jewelry on it'll go black, like my ring here. And you can't just polish it off. It forms an amalgam and the jeweler can only remove it by agitating it very fast in a special solution."

"You can't see it," someone complains, looking at the bottle.

"I'll put some out on my hand. Sit down and I'll bring it around." She waits for quiet before continuing.

"Is it wet?" one girl asks.

"No, it's liquid metal. See, my hand is quite dry."

"Isn't it poisonous?"

"Well, it's not just absorbed straight into my skin in such a short time, but you've heard about mercury poisoning of fish in the news?" (Several have.)

"Would it freeze?" a boy asks.

"Only at minus 38° or something."

"How do you pick it up?"

"It's very difficult; as you try to pick it up, it breaks into smaller and smaller pieces."

As she returns it to the jar, Miss Green issues an advance warning. "Tomorrow we're going to have an open vessel of mercury here. Don't be tempted to put your finger in it."

By this time Miss Green has shown the mercury around the class and everyone has had a chance to feel the weight of the bottles. For the last twenty minutes or so that remain she returns to more formal class discussion and more directly to the text. Now she takes the lead in asking the questions:

> *What are the reasons for wanting daily weather reports? Can we get accurate extended forecasts? Can you control weather? What is climate? What do we call the scientist who studies weather?*

The class answers promptly and almost all seem interested and attentive, though this class, too, has two boys flicking their pencils one against the other to see which one breaks first. Miss Green quietly removes the pencils and they subsequently pay attention.

Most of the questions are review questions which require single, short answers; but one question, "What makes up weather?" produces a list of items which Miss Green writes up on the board.

> *Wind. Temperature. Rain. Sleet. Air Pressure. Moisture [let's put that with rain]. Humidity [that can go with rain, too].*

Having got the list, they work through each item one at a time, beginning with wind. The students answer spontaneously, though most have their books open and some are making notes as they go along. They respond quickly and hurry the pace of the lesson along.

> *"What does temperature measure?"*
>
> *"How hot or cold it is."*
>
> *"Where does the heat come from?"*
>
> *"Sun."*
>
> *"What affects how hot or cold it is?"*
>
> *"The angle it strikes the earth."*
>
> *"What keeps us from getting too much heat?"*
>
> *"Wind."*
>
> *"Clouds."*
>
> *"Atmosphere."*
>
> *"Right, by screening rays."*
>
> *"Ozone."*
>
> *"Ozone, right. That blocks out harmful rays."*
>
> *"We've had this recent controversy. [pause] Temperature has more effect on weather than almost any other factor. How do we measure temperature?"*
>
> *"Thermometer."*
>
> *"By thermometer. What kinds of thermometers are there?"*

"Alcohol and mercury."

"Right. Let's go on to moisture."

"Is that how much rain you get?"

"Right. Rain and sleet and fog and snow [writing them on the board]. Could we also include humidity? The amount of moisture in the air? Why is it you find it hard to breathe in the summer when it gets very hot and humid before rain? Because the air is so heavy with moisture. But immediately after it's rained, you can suddenly breathe easier."

(She moves on to air pressure.) "What do we measure air pressure with?"

"Anemometer," one boy answers.

"Barometer," several students immediately correct him.

"What's an anemometer?" Miss Green asks.

"It measures wind speed."

Some of the class don't understand. "Let's go back," the teacher says. "Have you ever seen an anemometer?" picking up the two confiscated pencils and holding them in a cross. "It's like this, with cups on each piece which the wind blows around, and the wind speed is measured by how many times it goes around."

Next they consider the weather vane and Miss Green draws one on the board, pointing east. "Is the wind coming from the east or west?" Only three students guess right. "We name the wind from the direction it comes from--we say, 'ooh, that north wind feels cold.'"

"How do they name hurricanes?" someone asks. Miss Green explains how they are named in sequence. "I don't know why they are named after women. Maybe because they are more temperamental! Perhaps with equal rights they'll have to start naming them after men."

The bell goes to mark the end of the lesson and the class disperses to an assembly to salute American Education Week. Miss Green apologizes to me because she felt the class had been unusually noisy. It hadn't seemed noisy to me, but each school has its own norms about such things. What is interesting is the general point that in overcoming the problem of lack of interest and motivation amongst students, the teacher inevitably runs into the problem of noise. They are like opposite faces of the coin. A highly motivated class creates work for the teacher and carries a potential for seeming unruly. Within the climate of this school, Miss Green seems to be working hard to balance the coin on edge.

Next day I arrive at the same class, hoping to see the barometer being made. Miss Green explains that the assembly took up her planning period yesterday and she hasn't been able to prepare the sealed glass tube she needs to construct the barometer.

On Friday there are twenty-six students in class. Miss Green begins by collecting the day's barometric pressure readings from the class. At 7:00 a.m. this morning it was 30.2 inches and falling; outside it is pouring rain.

Miss Green holds up a sealed tube and says, "I want you to gather round the table and watch. I'll want one or two to help and the rest of you to watch." The class is extremely quiet. Miss Green takes a beaker from the cupboard, and finding it dirty, sends someone to Mr. Rodgers to exchange it for a clean one. When everything is ready she says, "Eddy and Patricia can help because they always answer my questions for me."

The class gathers round one of the front tables. Eddy holds the mercury bottle and Patricia, the glass tube. Miss Green runs the mercury into the open end of the upright tube from a syringe. Finding she can't reach, she gets a chair and stands on it. It takes the best part of the half hour to fill the tube, get the bubbles out and invert it in mercury. Throughout this time the class is not only quiet but silent. (Afterwards Miss Green explains to me that she had had a word to them about the previous lesson. As a result, we see the other side of the coin--if the class is kept down too much, then you lose the genuine questions and the curiosity that, as a teacher, you need if you are to get beyond instruction to any form of inquiry.)

The last twenty minutes of the lesson Miss Green reviews the work on air pressure for Monday's six-week test. The class begins to recover some of its energy and momentum and to ask some interesting questions. Patricia asks, if you put more mercury in the beaker at the bottom of the barometer, wouldn't this force the column of mercury further up the tube?

One boy is puzzled by the apparent similarity between the barometer and thermometer. For a moment I thought he was going to ask if you could use the barometer to measure temperature, but he doesn't quite make the connection. Asking about mercury and alcohol thermometers, one boy asks if you can color mercury. Miss Green confesses she doesn't know (nor do I).

Looking at the lessons described here from a distant, primarily non-educational viewpoint, I think any observer cannot fail to be impressed by the fact that the resources tied up in teaching here are almost entirely human resources. The buildings and furnishings are minimal. People are crowded into spaces and lesson follows lesson with little time to spare for teacher or for students. In purely economic terms, the proportion of the total input that goes into materials is minute (even with mercury at $20 a pound!). Most of the equipment and resources look run-down to a degree that would be unacceptable in any commercial or professional enterprise, not through mis-treatment but through sheer use. The exception is the textbook, which stands out, shiny and new (I'm told these are bought from state rather than local funds).

I find myself amazed at the continuing energy and good humor of all the teachers, and wondering how long Miss Green, in particular (as a recent graduate), will go on trying to get some kind of experimental approach to the subject established against all the odds.

It is fashionable in some circles to accuse the teachers of failing to implement the curriculum innovations that have been made in science over the last twenty years. It is often implied that the teachers do not want to change the way they teach and will do all they can to avoid doing so. Without wishing to imply that the teachers portrayed here should change their teaching, I think it is quite obvious that most innovative programs are beyond their reach simply in terms of equipment, space and resources. They work in a stable organizational situation, have good relationships with the students and have access to a remarkable natural environment. What they lack is even the most basic laboratory equipment and facilities; not the luxuries in terms of expensive equipment that is used once a year, but the microscopes, chemicals, glassware, space, even gas and water, without which it is really not feasible to contemplate a basic experimental science curriculum.

In writing this comment I had in mind a vision of an alternative pedagogy shared, I think, by many science educators. In fact it's more than a vision because you can see it in action not more than a few minutes walk from the classrooms in the Trade School, and perhaps particularly in the auto shop. Here the teaching is based on individual projects and is problem-centered, in the sense that cars come in for maintenance or repair and students work on them individually or in pairs. The teacher is available as organiser, consultant and supervisor rather than as curriculum ringmaster. It seems significant that this was the only place in the school I heard students call the teacher by his first name. Their respect for him was for his expertise rather than his position. The students in the auto shop work as essentially apprentices rather than as clerks and collectors of information.

It is possible for science, too, to be taught along these lines (perhaps the school system needs a scientist-in-residence like they now have an artist-in-residence). I don't know if Miss Green shares this vision, but she did feel I had overduly emphasized the material aspect of the situation, and perhaps undervalued the personal and professional qualities demanded. After reading this section she wrote:

> *As for equipment and resources, we are lacking; but if we really need something we can usually come up with it. It's true that if we had these things readily available, it would be much easier. As it is, we can sometimes let students work to get the things we need, which in turn motivates the students.*

Miss Green sees the key question, not in the provision of resources, but at a more directly educational level. She writes:

> *I'm striving to motivate my students to find something that they will be interested in. When I see them full of questions--really interested--then I find ways or sources from some place. To me the most stimulating experience is feedback from the students.*

I had to admit I've seen schools lavishly equipped for science where no real science was going on. On the other hand, I can't escape from the fact that it takes an enormous amount of energy for a teacher in Miss Green's situation to do anything even slightly out of the ordinary. That making those sorts of changes gets harder as time goes on, rather than easier, and that in the interest of survival most teachers soon drop to an energy level below that required to put a philosophy like Miss Green's into practice. In the recent past the turnover rate of young teachers in the profession has sustained the impetus for change in at least some schools. Given the current state of recruitment to teaching, that is a situation that must be changing.

The second impression that the science teaching in particular made on me as an observer, is the lack of outside support for the teacher in terms of classroom teaching. I started out this account with the question, "What motivates the students?" I don't think we can begin to answer that question until we understand more about what motivates the teachers.

The system is not big enough to support a science supervisor, and in a rural area it is a long way to the colleges and universities that might provide some leadership in particular curriculum areas. There are, of course, a lot of advantages to set against this; nevertheless, it seems to me that a major problem for the science teachers is that they have few easily accessible people with whom they can identify as biologists, chemists, physicists, scientists. Primarily they see themselves as teachers; and my guess is that the longer they teach here, the more this will be true.

Of course this, too, has undoubted advantages, but if the concern of the NSF is with the improvement of science teaching, I would think one line of development might be to enhance the scientific identity of the science teachers. At the present it seems something that science teachers can all too easily lose once they leave college.

When I raised the question of the science teachers' identity qua scientist in a small town community with one of the guidance counselors, she commented that a critical factor was that the town's doctors and pharmacists all aligned themselves with the private schools, and this seemed to cut the local scientists off from public school life. This echoes the superintendent's comment that the desegregation issue impinges on almost all other issues of any importance.

Why Does Patricia Like Science?

Observing Mrs. Griffin's and Miss Green's classes led me to feel that I should try to distinguish between motivation and interest. Motivation seemed to be something the teacher could create, or at least inspire, by skillful teaching. Interest seemed a more permanent and elusive factor, coming from the student rather than the teacher.

Patricia is the quiet girl in Miss Green's ninth-grade general science class who held the glass tube during the making of the barometer. It was also Patricia's question to Miss Green that if you put more mercury in the beaker at the bottom of the barometer, then wouldn't the weight of mercury press the column further up the tube?

The records show she has done well in general science, having virtually straight A's this semester. She'd started the year in biology but had lost some classes while out of school following an accident. On her return she had worried about the work she had missed (though she'd been a good student in biology, getting A's there, too). Eventually her mother came up to the school and it had been agreed that Patricia should transfer to general science. She didn't regret the decision; biology had seemed to be mostly learning words and some of them were long and difficult to remember. "Several of my friends who are still in biology wish now they'd done what I'd done. General science is more interesting and you get to do different things. The other thing is there is less homework to do."

When did she first get interested in science? She says she's been interested in science as long as she can remember, certainly since third grade; but what really spurred her on was being in Mrs. Clark's class in seventh grade. Mrs. Clark had clearly made a big impact on her. Patricia described her as "fussy, but she made science interesting and you got to learn a lot." Under Mrs. Clark's influence she'd joined the science club in junior high school and had won a prize for a project on cactus. Eighth grade had not been quite so interesting; there had been no experiments and mostly it was about planets and atoms. She liked experiments and found it was much easier to remember things when you had seen them instead of just reading about them.

I asked if she read science out of school, but, except for sometimes looking things up in the encyclopedia, she didn't, mainly because "homework takes up all your time. There isn't much time for anything else." She wasn't interested in science fiction or science magazines. She enjoyed the science she did at school and had always been quite good at it, but she really didn't know if she'd take it any further.

Words and Things

After talking to Patricia I talked to other students who confirmed that Mrs. Clark had been an early influence on their liking for science. I found Mrs. Clark in the junior high school and asked her if I could observe in her seventh-grade general science class.

I sat near the back of the class and was given a copy of the text. The introduction caught my eye. Under the title, "Using your book scientifically," I read the following:

> *Scientific information is the sum of present knowledge about the world and you, which has been brought together and organised. You, the student, absorb this knowledge by reading, remembering, and recording each fact. This is a process which must take place before you can relate or connect one idea or fact with the next.*
>
> *There will be many new words in your study of science. Each scientific term has a new meaning. Be sure that you understand what each new word means. Try to make these scientific terms part of your vocabulary. To communicate with others in science you must know the words if you are to express your ideas accurately. To help you in this way, the important words in the text have been italicised, pronounced and explained. . . .*
>
> *After you understand the meanings of the words, work at learning the meaning of each sentence, then each paragraph. Then, relate what is in each paragraph to the topic you are studying. . . .*

Blanc *et al* *Modern Science*.
Holt, Rinehart & Winston
rev. edition 1972
(italics in original)

Mrs. Clark is one of the most experienced teachers in the city and, as one of the first black teachers to work in the previously all-white junior high school during the voluntary desegregation of the late sixties, she has an identity in the system outside the subjects she teaches.

The class I observed had spent the previous lesson in study hall working on a test that Mrs. Clark had duplicated from the Teachers' *Handbook* (accompanying the textbook). The text chapter is called "The Diversity of Life," and the section covered by the test is mainly about plants, fungi, algae and bacteria. There are twenty-seven students in the class.

"How many have completed the test?" Mrs. Clark asks the class. Most raise their hands. "How many have mastered it so that they can talk about it?" A smaller number raise their hands. "It isn't enough just to be able to give the answers to the questions. You've got to know the words and be able to use them in sentences. How are you going to be scientific if you can't do that?"

Mrs. Clark stands at the front of the class and asks Shirley to tell the class what she has on her paper. Shirley is a tall white girl sitting in the middle of the class; she stands and reads the questions and her answers. After the first question she pauses, but Mrs. Clark asks her to go on until she reaches the bottom of the first page. Some of the words are long and difficult to pronounce. Shirley stumbles over "saprophyte" and ends up spelling out the letters rather than saying the word. "I have the answers," she explains to Mrs. Clark, "I just can't pronounce them."

Next, Mrs. Clark asks a black boy sitting up near the front to "stand up and expostulate." He has real difficulties and is unable to get past the first question. "I don't mean to pick on you," Mrs. Clark explains to him, "but I think we have what we want."

A girl stands and reads her answers to the first page of questions, perhaps not quite as fluently as Shirley, but with not too much difficulty. All this time Mrs. Clark gives no indication as to which answers are correct. Her main concern seems to be to listen to the students using the words. She reminds the class again, "You have to be able to master the words and put them in sentences."

Finally Mrs. Clark selects one of the boys: "Give me the answers to the first three questions, and I think we'll have what we need." Then she asks the class to turn to page 239, to the phonetic spelling of three bacteria types. In turn she asks a number of students to read: "coccus (KAH-kuhs), bacillus (buh-SIHL-uhs), spirillum (spye-rihl-uhm)."

Then a sudden change of tone. "Right," she challenges the class. "Right, all bacteria are harmful. Right?" There are some murmurs of disagreement. "You mean they're not?" Mrs. Clark asks the class. When it is clear everyone has grasped the question, she collects some answers, again without commenting on them. The students suggest that bacteria can take nitrogen from the air and make nitrate, that they can make organic matter decay, and some other things that are useful rather than harmful.

"We know that all bacteria are not harmful," Mrs. Clark exclaims, "but it isn't enough just to say it. You've got to be able to convince me that you know what you are talking about. When I asked you the question some of you said, 'No-oh.' I know from how uncertain you sounded that you don't know what you are talking about."

"Now some bacteria are harmful. Can you tell me about some of those?" The students make several suggestions, including scarlet fever. Mrs. Clark comments, "I don't just need the answer. I want to know the source of your information." Someone says page 240 and reads out the relevant section. Mrs. Clark says to the student who first answered, "You knew the answer, but you didn't know the page number. This is what we refer to as being scientific. You must know the source of the information."

The next problem Mrs. Clark raises concerns the growth of bacteria colonies. "Every twenty minutes we have new cells. How many do we have after four hours?" "128," someone answers. "Look at it seriously," Mrs. Clark urges, "Read that paragraph again carefully; and as you do so, I want you to become fully conscious of its true meaning." There's a pause. One of the students says, "After two hours there's sixty-four cells." Mrs. Clark says, "But I believe the author asks you to go on--if there are sixty-four cells after two hours, how many will there be after four hours?" "128," someone says. "Let's look at it seriously," Mrs. Clark urges again. "You've only scanned this paragraph. Would you read it with concern and then give an answer." There's another pause. "Yes, sir," she says to a student with his hand raised. "Multiply by two and you get 128." Mrs. Clark turns again to the text, "It says one cell gives you eight cells in one hour, and sixty-four cells in two hours. So how many do you get in four hours?" One of the girls begins thinking out loud, "In the first hour you get eight. and in the second hour you get sixty-four. So you get more in the second hour than you do in the first hour." Mrs. Clark encourages her to continue this line of reasoning, "Right, so . . .?"

"I have 256," someone offers.

"4026," someone adds.

"456," another.

Mrs. Clark tries to help out. "It's more than 2000. Sixty-four times sixty-four gives you what? The main issue is, you can see why the doctor quarantines you when you have a disease."

"3056"

"Four thousand and . . ."

"Four thousand and something," agrees Mrs. Clark while several students hurriedly try and work it out. "It's more than 4,000; close to 5,000. We can see how bacteria multiply, all right. We can make use of them, or they can be harmful to us. We can make cottage cheese out of milk if we are thinking about our waistline. Milk is a liquid. If you let it stand the cream comes to the top, and the milk is a liquid that will congeal like jello congeals when you let it stand. The cream can be churned to make butter, and the milk congeals and can be cut into layers." Seeing the expressions on some of the students' faces she adds, "You don't like cottage cheese, right? Mother gets it because she is watching her waistline. Milk comes from what animal?"

"Cow."

"And cheese comes from?"

"Goat," someone suggests.

Mrs. Clark changes the topic: "Let's talk about something else--parasites, saprophytes. What does a parasite do to a non-parasite, the animal or plant it is living off? How does the parasite make its living?" Chris says: "It lives off another plant or a rotten tree or something."

Mrs. Clark repeats the question, emphasizing she is asking about parasites rather than saprophytes. James suggests: "A parasite lives off another living organism's life substance."

At this point the text says merely that fungi are parasites or saprophytes (though the previous chapter included a paragraph elaborating the distinction between them). Mrs. Clark, however, chooses to extend the point further: "Parasites are sucking the blood out of another plant or animal, right?" She pauses. "Look in our community at persons who aren't doing what they should be. If we are doing all we can to beautify the neighbourhood by cleaning up the yard and planting shrubs and someone comes along and leaves litter, are they parasites?"

"Yes, ma'am," someone replies.

"If people are living on welfare and are not fully participating citizens, are they parasites?"

"In a way," a student replies.

"Explain that," Mrs. Clark asks.

"It may be all they can do," the student says.

"They may be old," someone adds.

"They may have been in an accident," someone else says.

Mrs. Clark accepts all these qualificatioen. "This is not a parasite, OK? If they are doing all they can and have paid their social security, it is all right."

One of the white girls asks a thoughtful question: "We're living off our parents, so you could say we were parasites." Mrs. Clark replies:

> *I don't want to make you parasites. Society owes you something, your parents owe you something. You have a right to education. But if you don't use your education and come to school and fool around, then you're a parasite. You are helping this community grow, but the person who sits around and doesn't work when there is work available, that's a parasite. As long as you are in school, your parents owe it to you to keep you, just like the federal government owes you social security. But over and above that we know there are people in school, in the church, and in the community who do not take a full part. In school there are those who fail to enrich the school program--at this point they become parasites.*

An important feature of Mrs. Clark's lesson to this point is that she has made very few comments on the answers students give to the test questions. In her class this is done by students' challenging the answers given.

One of the boys says: "I'd like to challenge number three on page 241."

"What did the person say?" Mrs. Clark asks.

"It was Shirley; she said 'roots and stems' and the text says 'bacteria lack chlorophyll.'"

Mrs. Clark replies: "OK, let's look at the higher plants. What are the structures?"

"Stems, roots and leaves."

"OK, so what is the challenge?"

"It says 'true tissue,'" someone suggests.

"Root is a true tissue. It's a structure and an example, OK? What is your challenge?"

"It says bacteria belong to a group of plants that lack true tissue like roots and stems," Shirley reads from the text.

"And your challenge?"

"Chlorophyll. It says on page 241 that bacteria lack chlorophyll."

"Stems, roots and leaves is the right answer. Give yourself credit for true tissue. Are there any other challenges?" Mrs. Clark asks.

Two more challenges in the nature of competing definitions are offered before the end of the lesson. No points are awarded for success. In one case Mrs. Clark offers someone a choice, "Do you still want to challenge, or are you asking a question?"

Comments. Mrs. Clark is a charismatic figure in class. The students watch her as she teaches, and she uses her voice to considerable effect, altering its tone, intonation and pitch. She is the kind of teacher who would hold the students' interest whatever topic or subject she was teaching.

In this lesson we can see her using the device we have seen before in Mrs. Griffin's class of elaborating the parts of the text that have some interest value outside science (here it is such things as the cheese-making process and excursion into the topic of social parasites).

Perhaps most striking is the way she stresses the students' oral expression. When they read, she listens, not just for the correct answer, but for the fluency and facility with which students use scientific terminology. This combination of teaching from the text and stressing oral expression concentrates attention on the task of defining and labelling terms. It is a well-tried teaching technique, particulary developed in religious communities. Much Jewish and Moslem teaching has traditionally been of this kind. It is perhaps not surprising that respect for the text and an emphasis on oral expression should remain at the centre of educational values in the Bible belt of the United States.

It is important to point out that Mrs. Clark does not use the text as an instrument of propaganda, for students are able to "challenge" answers; and the fact that the teacher often refrains from giving clear indications of correct answers means that this is a lesson where students are encouraged to think and to reason for themselves. The example of the student raising the question of students being parasites is a case in point.

The link between the culture of the classroom and the culture of the church seems, in this case, to be one of style rather than of ideology. Mrs. Clark is teaching science as though it were a language and using the book as a text, in a style which has its parallels in the Sunday School. Formally, church and school are separate (though three flags fly outside the high school; the United States flag, the state flag and a Christian flag). Though in a community where social life is largely dominated by the churches, and where the life of the churches retains a strong educational element, such continuity may be a key feature in the culture. Similarities and continuities between the cadences and tempo of classroom and Sunday School may connect to an oral tradition that is deeply incised in the imagination of children. The curriculum analyst may seek the replacement of existing styles of science teaching by a "discovery" or "enquiry" approach, and the related changes in the performance of the teaching role that follows. The effect of success in this enterprise may be to cause a disjunction between school and community, the detail of which must remain highly speculative.

The Voices of Students

Visiting Mrs. Clark's science lesson left me feeling that I had not adequately touched on what made students interested in science, as opposed to just liking science lessons. In order to pursue this point further I talked at some length with a small number of students in both junior and senior high schools. Accounts of a number of these conversations follows.

Tony (Seventh Grade). Tony lives out in the country with his mother (who is divorced). He loves the outdoors and spends much of his time fishing and hunting. While he sees school as important, he sometimes talks as though coming to school was a tiresome chore between fishing trips, a price to be paid rather than a positive attraction. His mother explains that there was a time he lived in town, but that "No one was ever more pleased to move back to the country. He often says to me, 'I never want to think of going back.'"

Tony is very enthusiastic about science. He is a bright student who consistently gets good grades and he feels science is his best subject. He likes science because it is close to his interests and what he knows; because "there is more to do in science than in other subjects," and because "you learn about different things." Tony says, "Science is not easy; there's a lot of studying, but it is interesting."

He is an avid viewer of Cousteau films and "Wild Kingdom," and thinks perhaps he would like to be a marine biologist. He told me about a sea fishing vacation in Florida including detailed descriptions of the habits of sharks, sailfish and dolphins. He is very observant, and an eager collector of information. He likes to read the encyclopedia entries on the different fish and animals he encounters, and at home he has built up a small collection of books on animals and fish.

Part of the fascination of the outdoor life for Tony is "just the different things you see. When you go out in the woods you never quite know what you will find." It might be a raccoon eating fresh-water mussels, a deer, or a beaver building a dam. Fishing, especially, is almost a science to Tony. He's noticed that catfish and bream take different kinds of bait according to the time of the year, the weather, the time of day, and a host of other things, including the phases of the moon. He seems to store each of these facts away in his mind as he encounters them, and enjoys the opportunity of talking to knowledgeable adults about them whenever he gets the chance.

The world of science has a tangible quality for Tony, not dissimilar to the world of the woods and creeks he knows best. It is a sense of reality few people possess and it carries with it a slight feeling of isolation. The world of hunters and fishermen is a world of the adult male, and is often alluring to teenage boys; Tony's grasp of a deeper quality that carries over into the world of science is more rare, however. He seems well on the way to appreciating some of the abstract qualities of the world of science, whether he continues with his formal education or not. It may be important to note that his science teacher is a woman, but she shares and understands his background. She explained to me, "I was an only child and had to be a daughter to my mother and a son to my daddy."

I asked Tony if he felt he could learn more about science by staying at home and exploring the woods and creeks. His answer, surprisingly, was no; a lot of science you couldn't learn from experience, at least in this part of the country. He felt science was not just about the immediate environment, but provided a window on a wider world. One of the things he liked about science was that it did provide some escape from the constraints of his limited world. He summed up his feelings saying: "Math is just a bunch of numbers, English is a bunch of words, but science is different. Science changes, you move on, you don't stay on one thing."

Bill (Eighth Grade). Bill is a student of few words, and he doesn't use those to say good things about school. It's not that he doesn't like school, his feelings are less active than that. School is just time that has to be served when he could be doing more interesting or more useful things. When asked to describe his ideal school he said, "It wouldn't be worth coming. There'd be no math, no science, no English, no social studies . . . well, social studies maybe."

Out of school he works on a farm and most enjoys driving the tractor; but overall, farming offers little more attraction than school. "Working in the garden don't seem worth it. It's a lot of trouble and you don't seem to get out as much as you put in."

The oldest of three children, his ambition is to be a truck driver. Four years seems a lot more school to wait out till graduation, but he has no plans for dropping out because his parents would be disappointed in him. A more immediate ambition is to own a car.

The one bit of the academic curriculum that seems to have reached him is social studies, but in the end it is still school. "It's all right to hear about the constitution and history and all that, but then you get a test and it's dull. You can often remember things when you want to but then you go into a test and get some dumb question you can't answer." Although social studies was his worst subject last year, this year it's his best.

On reflection, his ideal school would have less tests and it would all be computers; "You'd come into school, mash them buttons and away you go." "That's right," said his science teacher, "just like driving a tractor."

Steve (Eleventh Grade). When I asked people if there were any students who studied science out of school, kids who had chemistry sets at home and that sort of thing, everyone said I should talk to Steve. From the way students talked about him, it was obvious they felt he was a little different from them. He actually lived in a world of science and liked to speculate and talk about those things.

On first meeting, he explodes some of the stereotypes. Yes, he does feel a bit isolated in his interests; but he is also a 180-pound football player and champion weightlifter; activities that have won him a position of some respect in his peer group.

He lives out in the country and is an avid collector. He collects coins, old bottles and books. He has a library of science books, reference books and science fiction (Asimov and Tolkien are his favorite authors) but he talks too about H. G. Wells and Thor Heyerdahl, whom he admires considerably. He reads Popular Science and Popular Mechanics regularly, and also subscribes to a Science Book Club. He has a chemistry set and a geology set and analyzes rocks for fun. At Christmas he plans to get an optics kit. He builds and flies model rockets and model airplanes in a scheme organised by the Civil Air Patrol.

His interests are wide, but he most likes chemistry and math. "I've grown up around numbers," he explains; "Daddy is a clerk and I've always watched him work with figures. It always puzzled me how he could keep track of a sheet of numbers that was longer than I was. I couldn't see how he did it. So I sat there and watched him work with a sheet of numbers and a slide rule until I had it figured out." He adds with a smile, "Now in algebra I'm working with letters instead of numbers and my dad is working with a calculator."

Janice (Twelfth Grade). Janice is one of a family of six children. She has two older brothers who are both in college, a younger brother and a twin brother both in school, and a sister who died suddenly just before leaving home to go to college. Janice also has a baby boy born last summer. The family lives in a small wooden house in one of the two main black areas of town.

Janice is taking elective courses in advanced math, chemistry and home economics. She says:

> *I chose home economics because I wanted to learn to cook and sew and look after myself. I chose math because I liked it. And I chose chemistry because I thought I needed it.*

She has always liked math ("to tell the truth it's the only thing I ever have liked"). She has never had to work too hard at it ("my mother thinks I don't study for it because I don't bring no books home!"). Even when she has missed lessons, she hasn't had too much trouble making up classes.

She prefers to do math problems in school rather than at home, "because there are always people around you if you get stuck." But she is not too keen on working problems at the board ("I don't mind too much, but when you are up there in front of all those students you get scared you might get things wrong").

Although she has not had any trouble learning math, Janice never thought of herself as an outstanding student ("I never wanted to compete with all those A students"). In fact, she planned on giving up after Algebra II, but a guidance teacher persuaded her to continue.

Chemistry was a bit different. Janice had really wanted to take physics, but too few students signed up for it. Her brother told her she should try and take science and the guidance counselor encouraged her. After the first few weeks she tried to get out; "I was scared I couldn't do it," she said, but the counselor persuaded her to stay and she now feels that was a good decision. ("Now I'm doing pretty good and I like it.")

A lot of students are scared of math and science courses, she feels, because everyone thinks they are so hard. "Students think if you are taking chemistry and advanced math and geometry, you're taking the hardest courses and you must be really smart." Janice says she once felt the same but now she doesn't feel it holds much truth--"a lot more students could do math and science if they wanted to."

Keen Competition

Although the high school claims that its students are not tracked, there is a sense in which the curriculum contains elements of a selection system. Some courses are designed for the college-bound, including the higher level math and science classes. In these classes, competition between students often takes on a finer edge.

Mr. Rodgers' Physiology Class. Mr. Rodgers teaches biology (three classes a day) and physiology (two classes a day), both of which are electives. He admits this makes life easier: "The students are here because they've chosen to be here and they get on with the work."

For the teacher, a possible disadvantage of elective classes is the wider age range you get in each class; but Mr. Rodgers doesn't find this a problem. On the contrary: "I like mixture of ages you get because the ninth grades look up to the older ones a bit, and I find that makes it easier."

The other feature of elective classes is that you tend not to get such strong friendship groups in each class. ("In the second and fifth periods I've had to seat them alphabetically because there were too many friends sitting together, but it is more unusual than in required courses.") Mr. Rodgers echoes the feeling of other teachers about discipline: "There are no real problems this year. The girls are more of a problem than the boys for talking in class, and sometimes talking back to you, especially in the ninth grade."

Amongst students Mr. Rodgers is known as a teacher "who makes you work hard." "He expects a lot of you," one student said; and a parent went so far as to describe him as a "disciplinarian," but her friend felt this unfair. "He's very close to the students. I believe he's the first teacher they go to to get advice about their love life!"

What's it like to be in Mr. Rodgers' class? Let's look at a physiology lesson. Period three on Wednesday, in mid-November. Mr. Rodgers has the only classroom in the school that is even minimally equipped as a science laboratory--four benches down one side of the room, a shelf or two of assorted glassware and a rack of jars holding pickled snakes and reptiles ("We used to have more," explains Mr. Rodgers, "but once we had a break-in and they were left strewn across the room").

Most of the room is conventional classroom, the space taken up by some thirty-five desk-seats. Immediately, however, you notice another advantage of elective classes, for in this physiology class there are only eleven students. Elective courses are not necessarily taught in small classes, but they often are (ten is the minimum class size as a course to be scheduled by the principal).

Mr. Rodgers starts the physiology class with a spelling test. He reads out eleven words (examples: "autonomic nervous system," "proprioceptors," "neurolemma," "neuralgia," "myelin sheath," "excitability," "summation"). Ten minutes later, he collects the papers without comment and begins a recitation concerning some work the students have already completed. Each student is given a turn to answer the questions. It's a bit like a quiz. Mr. Rodgers reads out the questions, and if they get five in sequence correct, they score a point. If they get it wrong and can't answer, it passes on until someone gets it right, and collects a bonus point. Sometimes the questions go round the class (with mounting excitement) until someone scores. Almost all the questions (which come from the textbook) concern terminology or definitions.

"What are three characteristics of the nervous system?"

"What's the difference between a threshold and a sub-threshold stimulus?"

"What's the difference between the nervous sytem of the amoeba and the human?"

The answers come back in the stylized rhetoric of the textbook. Clearly the essence of the task has been to search the text for the sentence which contains the correct answer. Jane calls out in complaint, "Mr. Rodgers, you missed my turn!" Carla gives a particularly involved response to a complex question. Anita comments, "She must have asked her doctor" (is Carla the doctor's daughter, I wonder?). Mr. Rodgers says, "If you get them right, I don't care how you got the answers."

The whole thing is good humored and even exciting. One of the two black girls in the class turns her head from the action and appears not to want to take part (though when her turn comes she answers and gets most of the questions right).

Peter (who had ad libbed earlier questions) gets a long question about the transmission of nervous impulses. Instead of the customary text-style answer he simply says: "All or nothing." Angela, the girl in front of him, cries out full of mock indignation: "He looked at my book. He looked at my book. That's not fair!" Mr. Rodgers looks at Peter, and for the first time asks, "But what does that mean?" Peter hesitates but is saved by his friend: "He got it right. You've got to give it to him!" "That's right," someone adds, "You said you don't care how he got it so long as he got it right!" Mr. Rodgers graciously concedes the point, much to the amusement of the class and Angela's feigned disgust.

Halfway through the period Mr. Rodgers switches to a handout the students have been working from. This is a simple duplicated sheet with a diagram and some multiple-choice questions. The teacher reads out the questions and the students call out the letter indicating their answer in turn. The effect of this on the pace of the lesson is to quicken the excitement, especially when students get a succession of wrong answers and the possibilities of guessing right increase.

Mr. Rodgers reads: "Carries a motor impulse."

"(j)"

"Norma"

"(i)"

"Roger"

"Ooh this is 17, right? Oh (c)"

"Carla"

"How about (g)?"

("Someone already said that," someone calls.)

"Faye"

"(k)"

"Right"

"Oooh!"

"She's got a point! Her first point!"

In the next extended sequence, one [illegible] the black girls shakes her head and says, "Don't know." "Just give one," encourages Mr. Rodgers. Norma gets the next point by an obvious guess. "I hope your conscience bothers you," mutters one of the girls.

Some of the later questions require only "true" or "false" answers, increasing even more the chance of success by guessing. The groans, whoops of surprise, and lucky wins increase. Anita guesses one right but then Mr. Rodgers remembers she had forgotten to bring her paper to class and cancels her point. (By implication a new rule is established --you can guess and gain a point by a lucky right answer, but Mr. Rodgers explains you must do the work and bring your materials to class.) With ten minutes of the period to go, the checking of the work is complete and Mr. Rodgers quickly dictates some notes on the classification and function of nerve fibres:

> *"C fibres are the fibres with the smallest diameter and the slowest conductance --just one mile an hour."*
>
> *Someone says: "But there isn't a mile of nerve anywhere in the body."*
>
> *Mr. Rodgers explains: "That's just to give you an idea of the speed."*

He dictates fast and the temperature of the lesson subsides. The humor remains, though:

> *A fibres conduct pain--so when you're sitting at the football game, that's how you know your feet are getting cold! [Last week's game was played in record low temperatures.]*

Comment. Motivation is clearly no problem in this class. Not only are all the conditions right (a small, elective class), but Mr. Rodgers is skilled at judging the pace of the lesson and the climate of the class. The mood is one of good humor and enjoyment; he clearly enjoys the lesson as much as they appear to, always being relaxed but totally in control of what is happening. At the end of the hour it is almost a surprise that the time is up and how much work has been covered.

In emphasizing the way the class was taught, I may have neglected the content at the cost of emphasising competition for grades. On reflection it would seem the students would probably learn a lot in the way of terminology and definitions from this class. The "game" element I have described seems to have been treated with amusement by everyone (except possibly the black girl who remained relatively uninvolved). It might be a mistake, too, to think of "the game" as obtrusive, because throughout it was treated lightheartedly by everyone.

What did impress me was the ease with which Mr. Rodgers conducted the class--the spelling test to begin which (not too long) concentrated the attention of the students. The class response to questions, quickening through to the multiple-choice and "True-False" questions. Finally the short, rapid dictation, which brought the class down again before they left the classroom. In many ways a model lesson of its type.

At this point it might be useful to look briefly at another elective class in another subject to check whether student motivation is generally a problem in such classes, or whether the class we have just considered is exceptional.

Coach Williams' Algebra II Class. Like Mr. Rodgers, Coach Williams (who is also the assistant football coach) teaches mainly elective classes. When he first came to the school six years ago, the advanced math program was a single Algebra II course. Now there are two Algebra II classes, advanced math and geometry. Recently Coach Williams has persuaded the junior high school math teachers to offer algebra in the ninth grade, and next year hopes to start a pre-calculus course in high school.

> *We've only had pre-college math for the last two years. This year we have fourteen [fifteen] students taking advanced math, twenty-two taking geometry and nearly thirty taking Algebra II.*

Especially surprising, given national figures, are the numbers of girls in pre-college math classes--nine out of fifteen in advanced math, for example, four of whom are black. In the Algebra II classes I observed there were ten students (but another eight were out of class for 4-H club).

Currently the class is working on the simplification and multiplication of algebraic fractions. Mr. Williams takes the exercise they have been doing, assigns each student a problem, and they write their solutions on the blackboards. (There are boards on two walls of the room which gives each student plenty of space.) Having displayed their solutions, they return to their desks and Mr. Williams proceeds to go through each one in turn.

Each student describes how his/her approach to the problem and talks his/her way through the solution step-by-step. Obviously this is something they are used to doing and they talk easily and confidently about denominators, quotients, factors and terms. All the descriptions are accurate and precise and used with economy. Mr. Williams lets errors pass and tries to get the class to discover them:

> *"I don't understand how that can be," Jane comments on a student's solution. "How do they cancel out?"*
>
> *"Good question," adds Mr. Williams, "can you cancel from numerator to numerator? No? Right."*
>
> *"So his answer's wrong?" Jane asks.*
>
> *"Correct."*

On the other hand, Mr. Williams will often extend and elaborate an answer by giving counter examples. His style of teaching is marked by total fluency with the material. When difficulties do occur, he rapidly works back to a point where the students understand what is happening. For example, when a student has confused the sum of two squares with the difference between two squares: "Is subtraction commutative? [pause] Remember when we did this before? [pause] Is a-b the same as a+b? [pause] Is 5-4 the same as 4-5? No. Right . . ."

He reserves special delight for the elegant solution:

> *Eight and ten are good test type questions. They evaluate you on how well you can simplify and they evaluate you on how well you can factor. They're difficult but they're not beyond your learning.*

As in Mr. Rodgers' physiology class, the game element seems strong; but here it is more muted. If the physiology class was essentially a quiz, Algebra II is a game of strategy. Here getting the right answer is not as important as the elegance and economy of your approach to it. At one point someone makes two errors and yet somehow ends up with the correct string of terms on the bottom line.

> *"Would she have got it right on the test?" Chris asks.*
>
> *"No," explains Mr. Williams, "because the procedure is wrong. The answer is not important; it's the procedure. You could get the answer wrong and still get nine points out of ten. Do you remember when we discussed this at the beginning, when we talked about the fairest way of marking problems?"*

If there is an air of competition, it is not so much between students as between the mathematician and the problem. When a problem is solved, Mr. Williams gives praise; but he tries to make it objective rather than personal: "A good problem. It worked out real good." And towards the end of the lesson, when he wants to move on to the next section of the text:

> *"I want to go on to the next thing--division of algebraic fractions."*
>
> *"But some of them are away," Annette remembers.*
>
> *"This is so easy they'll soon catch up," jokes Mr. Williams.*
>
> *"So tomorrow we can sit back and take it easy," someone replies.*

But at the end of the class, Mr. Williams returns to the point:

> *"Don't tell the others what we've been doing because they might think it's difficult. Remember how important first impressions are. . . ."*

Both the classes we have considered have been elective classes for the more academic students who represent perhaps 20% of the high school population--those who aspire to university or four-year college on graduation. These are the students you would expect to be most strongly motivated in class. They are, after all, the ones who apparently have most to gain from success in school.

A NEW GENERATION

The pages that follow are extracted from conversations I had with eight high school graduates. They are not typical, since they represent the 20% or less of students who have gone on to college. But what they said seemed to me important. Deciding how to present what they told me was difficult. Each had a different story to tell. In the end I chose simply to select, condense and summarise what each of them said, leaving the reader to draw inferences and make some sense of the total.

Dave

Dave is in his first year at State University, studying criminal justice. Son of a Post Office administrator, he spent the eighth and ninth grades in Pine City Academy before returning to the public school system.

Dave was class president in his senior year, entered the co-op program and served as a state officer in the vocational education club. He felt the program was a valuable one, partly because it "keeps a group of students in school who would be working anyway," partly because he enjoyed his work as a local radio disc jockey.

He didn't take general science but went straight into biology in grade nine, a move he now feels was a mistake: "It was really a course for tenth- and eleventh-grade students." To some extent this experience put him off science, though he has just done an earth science course at college which he enjoyed.

> *I knew by ninth grade I wanted to go into criminal justice so I found myself asking, "why biology?" It's a question a lot of students ask themselves. Why science? And it's not a question that school really answers. I think teachers need to bring out the practical uses of the subject more, that would help. Though I don't know to what extent.*

He agrees that many Pecan County children have an extensive knowledge of natural history. "Kids here know a lot about how to scale fish and the different parts of the fish, and the same with squirrels, deer or whatever. But the teachers never bring this into science. It's like two quite separate things."

The main exceptions were when he had to make collections of insects and leaves, though it seems this was ultimately an identification and labelling exercise rather than anything else.

This does not mean Dave would have preferred an open, exploratory kind of curriculum. He likes teachers who closely follow the book. "I'm small town. The books are written on a real high level." He felt the teachers' interpretations or extensions of the textbook were often confusing or inaccessible, and that they should have stayed closer to the text.

Dave had a number of misgivings about testing. He felt there was often a large gap between what students understood and what the tests measure. "Students often learn a lot more than teachers realise. I don't see how you can honestly test a student on his knowledge when it's really the teacher's knowledge you are testing. The teacher gives what he knows and then gives a test to see if the student knows it. To be a teacher he has to know more than the student to start with, or the student would be teaching the teacher. I see giving tests as a way of learning but not as a way of grading a person." Some of his teachers, he felt, were concerned to discover what the students learned and understood rather than simply how they scored on tests. He singled out Coach Williams, the math teacher, and one of the social studies teachers.

> *They gave you credit for the way you did things rather than for the answers. Coach Williams would go through a problem step-by-step and give you credit for the tests you got right. If it wasn't for that, no one would have passed math!*

The main problem he feels is "right and wrong" tests because "these discourage people, and students do get discouraged by test results."

Tom

Tom took high school courses in Algebra I, geometry, Algebra II, advanced math, general science, chemistry and physics. He is now an engineering student at State University on an ROTC scholarship. Although he took a wide range of math and science courses, it was drafting that led him to engineering.

Drafting was a course he "wanted to try," and several of his friends took it, too. Once into it, he got more interested and wanted to go further, but felt the teacher was handicapped by the students in the class who thought it would be an easy option:

> *The students who wanted to get on were outnumbered by those who just thought it would be easy. We could have done more in the way of practical applications. The teacher wanted to do some surveying, but too many people were not interested, and it would have been difficult and perhaps led to discipline problems. He was going to teach us to use the slide rule, but again not enough people were interested.*

Like several of the students I spoke to, Tom felt more comfortable with math than science, and, within science, with physics rather than other areas of science. Chemistry especially he found hard: "General science was physical, you could almost put your finger on the phenomena; but chemistry was very abstract."

It might seem strange that algebra and advanced math can be tangible, yet chemistry seem abstract; but perhaps this indicates a particular form of imagination, and perhaps of intelligence that seems natural to an engineer, if not to others. The way Tom described it, the thing about math and physics (and drafting) was that you could see things in practice. He got a part-time job in the textile plant where his uncle was a maintenance engineer and there saw a lot of the principles and machine parts working. Chemistry, though, was "like another world" and he felt it was harder to imagine the phenomena.

In the engineering course he was following, the instructors seemed to be making an attempt to build in some sense of relevance. Already they had talked about energy conservation which, through government regulation and public concern, was becoming an important factor for mechanical engineers. The course had included a visit to a house heated by solar energy. The introduction to electrical engineering had begun with medical applications: EEG's and ECG's, rather than with theories or simple circuit boards. In addition, Tom was required to take courses in world history and in "technology and civilization." So it seems that there is some evidence that this college at least is responding to some of the criticisms voiced by John Stephenson (see "Other Voices" section).

Reflecting on the quality of his education overall, he felt there was a tendency not to think too far ahead, perhaps not much "beyond the next test." He wasn't clear about courses he would take next year.

> *Maybe that's just the American way [he added]. Sometimes I'm not sure if it's a very good way because you tend to learn where you go to find something out rather than how to do it. Like square roots. I don't know how to find the square root of a number if it's not a perfect square because I've never been taught. The instructors tell you there's no need to know because you can always look it up in a table. I'm not always sure about that, but maybe I should have tried harder to find out for myself from books.*

Carol

Carol graduated from high school two years ago. She is now midway through a nursing degree at State University. She, too, found math easier than science: "Math was easy, I just breezed through it." Science, she felt, was harder, and she remembers the Bohr atom models of reduction and oxidation as "kinda confusing." When she had difficulties understanding, she tended to talk to other students about them rather than the teacher, but felt the most important thing in any course is "to get an understanding with the teacher." In one course she found hard in college, she felt the main problem was that she couldn't "get along with the teacher."

She did not find too much gap between high school and college courses in biology and chemistry, but wishes she had had more lab work in school. "It makes it more interesting and easier to learn." In her senior year Carol went into the co-op program. If she hadn't, she would have taken advanced math; but faced with the decision, she stayed with the co-op scheme: "It was my first job, the experience was useful, and so was the money!" That seems to be about the order of importance of things for Carol in making the decision, and after all, she already had more than the math she needed to enter nursing.

When she graduates, she thinks she will work out of state (for the experience), though probably in a small town rather than a big city. "I know the wages are lower but I like small towns. I'm kinda slow myself!" At least to start with, she doesn't think she would want to return to Pine City, though the difficulties of breaking through the segregation that still exists in the town hospital is not the major reason. "That'll probably change," Carol says. "I'd just like to try working somewhere else."

Gail

Gail graduated from high school last year and is now a student at State University studying psychology. The oldest in the family, she has a sister in ninth grade and a retarded brother who's thirteen.

Her brother has been an important influence in her life. She has found herself looking after him in order to give her parents some break from the demands he has made on the family, and she has watched psychologists and doctors working with him. Consequently, her interest in psychology is practical rather than academic: "I'm not going to school because I want to teach psychology. I want to really do the field work, working with retarded children. I want to understand more." She feels that going to college is important because some of the people who work in this field are not qualified and however good they are with children, do not really understand the reasons for doing things. Nevertheless, she feels her experience is important because it has given her an understanding of retarded children she could not have gotten from books. "I've lived in it. I understand my brother. It doesn't bother me that he's like he is, but it upsets a lot of other people."

So far she is very disappointed in the general psychology course, which she feels is very dull and from which she feels she hasn't learned anything. "I like the films," she says; "I learned from them, but the book isn't anything like reality." Part of the problem for Gail is adjusting to the teaching method.

> *I'm used to being taught, but at college we have to read the chapters and then discuss them in a group of five students without an instructor. A lot of the students aren't interested and they just talk about parties and football games,*

> *and that way you never really learn anything. Next day there's a pop test, and every week it's the same routine. I didn't really learn anything except what I'm really interested in, like child behavior. The things I wasn't interested in I didn't read the chapters.*

Don't the tests catch her out? "Well," she says, "the tests are all multiple choice and the words are in the text in italics; so if you just look through those, you can usually guess the answers."

At high school, Gail took courses in biology and chemistry, Algebra I, Algebra II, and geometry. She would have also taken physics and advanced math, but in her senior year chose instead to go into the co-op program. This meant she took two hours out of school to work in ladies' clothing stores. She admits she did this partly for the money, but also for the experience. "It's much easier getting a summer job when you're in college if you have some experience to offer."

She always liked math, even though "a lot of my friends wouldn't take algebra or geometry because they said it was too hard. It's the name that would scare them." She thinks this is especially true of blacks. "You don't find many blacks in math courses, or in chemistry; and if you do, they're the ones who are college-bound."

Gail always knew she was college-bound, even though no one in the family had been to college. "I was always told I'd go to college. I was always told, 'You go to school and get your lesson, and before you know it you'll be going to college.'" Her parents were a great influence on her; in fact, she sometimes wonders if she would have gone to college at all if it had not been pounded in her head so much. Her mother especially watched over her progress at school. "She just couldn't bear to see a 'C' on my report card. If there was, I'd be grounded, no going out and no phone calls." Gail says she tried hard to please her mother, maybe more than to please herself; but now that she is at college, that impetus is less direct. She is taking music as a minor option and a few weeks ago had to play to an audience of five professors. "The night before, my mother called and asked what I was going to wear! But this was something I did on my own. I got good grades and was very proud that my mother wasn't there! I did this on my own."

With home being such a strong influence, you might think it would be hard for Gail leaving Pine City. But she likes the social life of the university, and in some ways finds life in Pine City restricting.

> *Quite often when I'm depressed and need some excitement [she told me] I'll go and stay with my aunt in Detroit. She drives a city bus and I just like to ride the bus all day looking at people. For a country girl like me, that's real interesting! . . . When you come back, it looks dumber and dumber. I just think, what have I been doing here all my life, because it's so small. There's not really anything to do.*

It would be wrong to think Gail did not have any sense of purpose while she was at school in Pine City. In fact, she only took science courses because she had long-term aims in mind: "The truth is I really don't like science. I hate it and I always have, but I was ambitious so I passed the courses. A lot of times you get into courses you don't like, but you're ambitious and you know you need it."

Three weeks into the chemistry course, she almost gave up. Her friends didn't help because they all told her the course was too difficult and she'd flunk out (none of them took it). Again it was her mother who made her stick at it, and in the end she enjoyed it, mainly because of the teachers (Miss Green and Mr. Rodgers).

> *I did enjoy the science courses, even though I hated science. I went in there with a negative attitude, but I did enjoy it. When the teachers are nice it makes it easier for you to accept them and the subject you're taking. I never did like science, but I enjoyed it more than I thought I would because of the teachers.*

Like a number of students I talked to, Gail felt a clear distinction between math and science. The former she enjoyed and felt confident about (except perhaps geometry), but science was a different matter. In trying to explain the different intellectual demands that the subjects made, she said:

> *I enjoyed chemistry more than biology [in the end] because chemistry is more numbers. Biology was mainly learning the names of things. I was interested in the dissections but they were mainly to learn the names of the parts, not how things worked. But chemistry was more interesting because there was more explaining why things happen, and different theories.*

The dissections and the little lab work they did she felt was useful, because "it made you feel like you were doing something. You got to see what you were doing. You really felt you were into something."

Jennifer

Jennifer graduated two years ago and is just about to graduate from a two-year college in the state's largest city some one hundred and fifty miles away. I talked to her about the relationship between education and employment, and between rural and urban life.

Jennifer was clear about the elements of segregation that remain in Pine City. "There's a big red line," she explained. Some restaurants will not serve blacks; there are two community centers--one black, one white; and a number of jobs are still closed to blacks: in the banks, the Power Company and Telephone Company offices as well as City Hall and the County offices. "It isn't because blacks haven't tried," Jennifer explained, for she had tried to get a summer job in the banks only to find unqualified white girls doing the same work. "They have a line," she said, "and it's going to take some pushing to get past it." In fact, she thinks it's going to take federal intervention.

Jennifer feels the only jobs really open to blacks are in education; but even there "blacks don't often get jobs beyond a certain level, whatever their qualifications." Overall, she says "we're held back. We can only struggle."

What is the role of the school, I wondered. Is the school system creating a generation of blacks who will not easily accept the situation, or is it helping them come to terms with the way things are? Jennifer didn't feel it was so simple and clear cut, but she admits she is ambitious and that she found the school mostly encouraging. "Round here you mostly don't see much progress, you just accept things the way they are, but school has helped."

If you are black and ambitious, you have to leave town. During the time I was staying in town, a black woman celebrated her one-hundredth birthday. That day you could see where ambition had taken people. The Holiday Inn was taken over for the day by blacks in furs and city suits; and outside, their cars (several Cadillacs) nearly all displayed Michigan tags.

Jennifer pointed out that there is a cost, too; for city living is quite different from life in Pine City. "Being in a small town you never meet any big challenges. Renting an apartment, finding your way around in the city, knowing how to make friends, all those things can be hard if you are not used to city life. Coming up in a small town you don't really learn to be independent."

In school, too, there are disadvantages that Jennifer has felt in competing with city girls. These are hard to specify, for though the curriculum does not offer just specialized courses, it is fair; and the faculty, though locally oriented, is well-qualified and competent. It is true that equipment is not good, and she feels perhaps the counselors are not fully aware of what is available in the city simply because they are distant from it and lack contacts.

As I talked to Jennifer I became aware of two intricately related aspects of disadvantage. The disadvantage of blacks against whites, and of rural against urban areas. "Perhaps small school systems need more money than cities," she suggested, "or courses in city living." Though as we talked, we agreed it wasn't courses that were needed so much as experience, perhaps through an exchange system or, more ambitiously, an urban studies center where students and faculty could work and study in a city environment.

Jennifer sees past the aspirations and the rhetoric of the Pine City school system, and what she sees is a small town system trying hard but still with a long way to go. And not all the barriers are outside the schools:

> *You can have a white instructor in school; you see him every day and perhaps you'll chat to them sometimes and maybe you'll get to know them a little. But you'll meet them downtown and there'll be an avoidance. Maybe they'll have their husband or their daughter with them, and I've even had them look straight in my eyes and not say anything. And nor would I, because you know that deep within there is still a certain prejudice.*

Jennifer is in a good position to have observed these things, for when she was in sixth grade she was one of five black students whose parents sent them to all-white schools under the doctrine of "freedom of choice."

OTHER VOICES

So far in this report we have looked at the school system mainly from the inside. In the context of the study it seemed valuable also to try to get some view of the schools from outside the system. The accounts that follow make no claim to be representative, but they record some of the voices to be heard within the community.

Rev. Gibson

Rev. Gibson shares some of the issues and concerns that face Mr. Tyson, the superintendent. He, too, is an outsider to Pine City who came into a difficult and delicate situation with an impressive reputation, having been involved in the Civil Rights movement in his church locally and nationally. Coincidentally, he and Mr. Tyson were friends from years back, having been in college at the same time.

Rev. Gibson arrived in Pine City at much the same time as Mr. Tyson and met similar problems. In his case, the immediate situation he faced was a major division in his church that had split families and created almost as much local debate as the desegregation of schools. Part of the issue was congregational as against church control, and Rev. Gibson came into the remnants of his church as the Church-appointed minister.

Like Mr. Tyson, he is a man of vision with the ability to translate his ideas into action; he has quickly established himself and become a significant voice in the city on many issues of importance. During our stay in Pine City an interdenominational service was held for Thanksgiving, said by some to be the first time whites had attended a black church except for funerals. It was significant that Rev. Gibson was chosen to give the sermon.

Perhaps unusual for a minister, his vision of the immediate future is primarily bounded by economic themes. He sees society increasingly dominated by public sectors of the economy rather than by the private sector; a movement to service industries which may well be accompanied, or quickly followed by, a slowing of economic growth. As a consequence, he sees the process of integration depending on the willingness of whites to make adjustments in their standard of living, to allow for more blacks to assume responsible decision-making positions in the community.

To date he feels integration has largely been achieved against a background of increasing prosperity, allowing some improvement in the living standards of blacks without too much cost to the white community. That stage of integration, he feels, may well be at an end; and the white community may be faced more directly with moral and social issues, as well as adjustments in their standard of living.

It is interesting to note that the prosperity that has made integration possible has also created tensions in the city, for it has created the new shopping plaza on the exit to the interstate highway, and has meant shifts in political control from the aristocracy to the business and professional community. (Ironically, some lawyers who constitute an extremely strong conservative force in the city are said to have made much of their money out of the legal jungle of civil rights cases and federal court hearings.) The effects of prosperity have been two-edged; they have made some changes easier, but have created others which in the long term may have considerable effect.

Rev. Gibson is well-informed about education, a confidante of the superintendent in times of trouble. His wife teaches part-time and he has one child in high school, with two older children having received their high school education in the public schools during the time of total integration. Looking to the schools, he sees the significant factors again as primarily economic. He feels the extremely low property taxes in the state and the low proportion of taxation headed for schooling as constituting a major educational constraint, and one he expects soon to change. Considering student attitudes, he admits that he faces similar challenges as a minister. The old and the very young constitute the bulk of the congregation in most of the city's churches, and he is concerned that between high school and parenthood a generation has drifted away from the churches.

Five Gospel Minutes

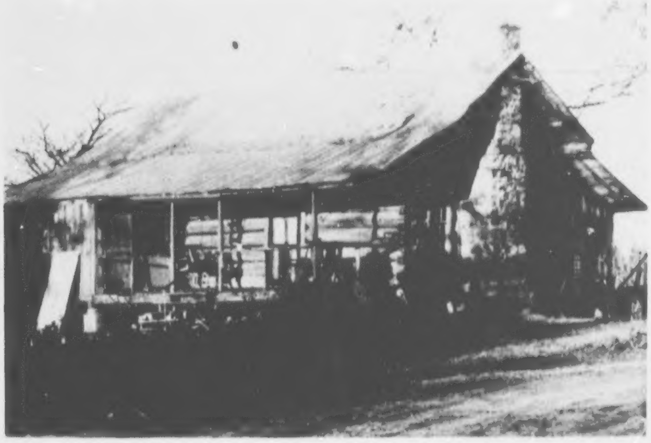
Whenever I asked people in the school system if there was any religious control over the curriculum, this was always vigorously denied. No one could think of any examples of pressure being brought to bear by churches, and those teachers who were teaching in controversial areas felt that, if anything, they would welcome more outside interest.

Driving down the interstate some two counties away, I heard a local radio broadcast in which a minister launched a major onslaught on evolution. He attacked "Humanistic thinking based on the theories of Darwin, which treats the Bible as just another document. This leads to a denial of God's truth and results in relativism." It was an articulate and powerful argument delivered with characteristic force.

The same week the Pine City radio station broadcast a service from Reverend Gibson's church. The sermon was a comment on the federal government's decision a few days before to continue with the development of a supersonic military aircraft.[2]

Mr. and Mrs. Smith - Parents

Mrs. Smith lives in a log cabin that has been in her family for near enough a hundred years. She has three grown-up children and another three in high school. Her husband is a carpenter but they also work the nineteen acres of land that remain as their share of the family farm.



To visit the Smiths is in some ways to visit the past. Though they have had electricity and the telephone for a number of years, many of the older ways persist, too. Their milk comes from a cow, not a carton; they grow the vegetables they need and much of their meat comes from the deer they hunt in the woods, or from hogs they raise themselves.

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[2] Rev. Gibson comments: "I used this only as one illustration in the sermon, seeking to depict the darkness of war threats, as part of the darkness which tends to put the light of truth brought by Jesus Christ out. My sermon was 'The Dark World's Light' based on John 1:5. I would not want to give the impression that my sermon was an attack on the government."

The young Smith children (two girls and a boy) are triplets. When the schools were desegregated in 1970, their parents could not contemplate private schooling because of the cost. "We might have been able to afford for one to go, but not three. It was hard enough finding the money to clothe and feed them." Watching them eat as they return from school, you can see what Mrs. Smith means.

On the whole, parents and children are happy with the way integration has worked out in the schools. It is not, perhaps, something they would have chosen to happen; but given that these things are decided by others, it could have been a lot worse. Looking back, they don't feel there would have been any advantage to private schooling.

The children are perhaps more sure than their parents. The girls are energetic and confident and look likely to make the best of whatever situation they put themselves in. John, their brother, is less extrovert and his life revolves around the farm and the woods, rather than friends and school. He is another of those kids who has a remarkable knowledge of the natural environment and likes nothing better than "hunting or just running wild in the woods."

There was a time when his kind of background would be thought "narrow" and limiting. These days, with cars, with the world shrunk to a village via television, and the county to a family via the telphone, "narrow" doesn't seem the right adjective. It seems families like the Smiths have all the advantages of living in the country, the community life that comes from neighbors and the church, and access to many of the things that in earlier days only city dwellers had.

It might be thought that integration would be easier to achieve in rural areas because blacks and whites were more used to each other. This doesn't seem to be true. Pine City has black sections, but it is not big enough to have black ghettos like the big cities. And in the country, too, residence is often segregated. Indeed the school buses are often predominantly "black" or "white," and students use those adjectives to describe them.

Although it is true that in the past blacks and whites often worked together, habit and custom also kept them separate. Churches are quite separate, and we have already seen how one teacher remembers as a girl being kept in the house when the blacks returned from the fields. Since the plantation days, so many of the farms are part-time enterprises employing only family labor that the "closeness" of blacks to whites in the country is probably exaggerated.

Accepting integration in the schools has been no easier for the Smiths than it has for families who live in town.

Preston Ward - Local Industrialist

Preston Ward is a manager of a manufacturing company which produces protective gloves. He is also a city councillor and generally considered to be an important man in the town. This in itself reflects some of the social changes that have occurred in the town in recent years. Someone comments, "It always used to be the aristocracy who ran things here, but having men like Preston on the city council has meant big changes for a lot of people."

The company Preston Ward manages is part of a group based in the North; but it is run as a "profit center," and for most purposes could be considered an independent enterprise. It has been in the town some fifteen years and occupies a building previously used by another textile company. The present plant employs around 600 people, mostly women machinists who stitch the gloves together. By some standards it may seem a small plant, but with a pay roll of $1.5 million a year it represents a major feature of the local economy. (The school board superintendent pointed out that he'd heard local finance and loan agencies soon knew when business was bad in the glove trade.)

The work is piece work, and the rate of pay standardized for each job. The ethos of the plant is dominated by speed, efficiency and an air of competition. The machinists work at remarkable speeds, colored ribbons above their machines advertising to all how far above the standard level of output they are working. Each works within easy view of a clock, while charts above them indicate the quality level of the output and the number of accident-free days that have been worked.

How does Mr. Ward see their job?

> *It's not a job people aspire to, more one they end up doing. I don't want to imply by that, that they are in any way poor workers because we have a fine group of people here, and it's not an easy job to do. They have to take selection tests for this work, and we have to give them quite a long training program. [It takes about six months to learn the job.] But we have to face the fact that if you went up to the high school and asked the students if they saw themselves working here when they graduated, there are not many that would. Most students aspire to something they feel is a little better, and I think it is quite right that they should feel that. The job the women do here is one they come to maybe after they've had children, or they've tried other jobs since leaving school.*

Recruitment is often through families or friends:

> *We have families and we encourage them. Husbands and wives, mothers and daughters, sisters, aunts and cousins. It's a happy place and they are fine people.*

This judgment is borne out by staff turnover figures (2.5% annually compared to 5% per month in the state as whole), and by the good-humored and easy way they leave work at 4:30. Almost all the workers are residents of the county, and they tend to be country rather than town people (about 75% from the country, Mr. Ward estimates). Commuting twenty miles a day to work is quite common. Has the nature of the work force changed much in recent years?

> *Well, we used to schedule for 96% attendance, now we average out about 92%. [But Mr. Ward adds] There was a time when you could say to someone, "Be here," and they'd be here, come hell or high water. You can't do that now, and it's right that you can't. Some managers used to run their plants that way, but it isn't the right way to treat people. It isn't right now and it wasn't right then.*

As manager and as an employer, what does Mr. Ward see as the function of the school system?

> *The right attitude to work is what we need, not specific training for the job. If industry gets people with the right attitude, we can teach people what they need to know, probably better than the schools, because we can teach them on the job.*

This might be seen as a criticism of the vocational and trade schemes in the high school, but Mr. Ward does not see it that way:

I don't want to be seen as criticising the co-op program because I think they do a really good job. But what is most important about the program is the attitude that the students learn towards work rather than the job training they get.

[He adds] You can only buy 70% of a person's effort. The rest has to come from them, and it is in that area that the schools should concentrate, and it's something maybe only they can do.

John Stephenson - Engineer

John Stephenson is in his mid-thirties and works as chief engineer for a company that builds specialised equipment used in forestry. The company is part of a group based in the North, but operates independently, designing and building its own machines. The factory is small (around 100 employees), the product high cost and the output low. Each machine being assembled on the shop floor has already been ordered by a particular customer, and some are individually designed to order.

John Stephenson offers several perspectives on science education--as a practising engineer as an employer, as a parent, and as a teacher (he teaches evening classes at junior college). For this reason, his views are presented here at some length.

As An Engineer

A native of New Jersey, John graduated from Stevens College in the late fifties:

When I graduated there was a sudden demand for engineers. It was the time of Sputnik, and it seemed there wasn't just a demand for engineers, but that we were entering a Technological Society, in which people saw no limit to what you could do with machines, or an engineering approach to problems.

Since then, of course, there has been a total change in climate. We've seen the growth of the environmental and ecology movements, and people now feel that perhaps technology has got out of hand. The enthusiasm for engineering has cooled off.

How did the cultural climate of the late fifties affect the kind of engineering education John received?

When I trained as an engineer I attended what was purely a science college with no liberal arts course. Maybe we had an hour of Shakespeare one Wednesday afternoon, nothing more. As a result we had a very narrow background. We were trained to join a closed society of engineers.

This kind of specialist education had a number of consequences; especially, John feels, for those like himself who had gone to college straight from high school and actually had little idea what engineering was like. Their motives derived as much from success in high school as from any sense of personal destiny. Not surprisingly, many dropped out; and of those who graduated, not a few remained confused about their future careers. They were engineers because the education system had carried them along to the point of graduation, rather than from any sense of personally controlled internal momentum.

John admits that his education disoriented him to some extent, but now he is critical of his education for much more significant reasons. Having established himself as a practising engineer (an identity that is very important to him), he feels that his specialist education was in many ways inadequate. It was based on a set of ideas and values about the nature of engineering that, in turn, was derived from the climate of the "technological society." One way this showed itself was in the strong academic bias of the teaching he received:

> *The professors who taught us were academics, not practising engineers. They might teach you the theory for designing a set of gears, but they would never have had to make such a thing themselves, and they didn't know what to do when the production department said, "That'll cost $300 to produce, and you've got to do it for $30."*
>
> *So the tendency was for us to want to stay in the system when we graduated, because we were frightened of those kinds of practical questions, or just didn't know how to handle them. We took PhD's and taught the same theories to another batch of students. Or we went out to work for the big companies like Lockheed, where they'd maybe have a thousand engineers and you would be able to specialise, and to some extent be protected from more basic questions.*

John feels that one effect of the student unrest of the sixties has been to break the circle by which academics simply replicated themselves on college faculties. While not condoning every aspect of campus unrest, he feels the important questions the students raised were questions about the curriculum, and that in doing so they were voicing many of his own concerns and those of his contemporaries:

> *The students kept asking for relevance, that was the keyword of the sixties, and I think they were mostly right when they said a lot of what you learned in college was irrelevant and bore no relationship to what happened out there in the real world.*

John feels that, to some extent, he has had to work against his training in order to become the kind of engineer who works with real world problems. Most of this has come with experience; but he has ventured back into formal education, completing a law degree in evening school.

From his contact with local universities, John feels there are signs of change, and that higher education is beginning to respond in some way to the experience of his generation. Through professional association meetings he has met the chairman of the engineering school of one of the state colleges. It seems this school is actively trying to recruit practising engineers to the faculty, and is also offering the students more general courses in economics and business studies. (In part this is probably a result of the recent downward trend in the employment of specialist engineers, rather than what John would like to see, which is a strengthening of professionalism amongst engineers.)

The distinction between specialisation and professionalism is an important one, and one that in the past we may have often confused. John clearly feels they are not mutually dependent, but argues strongly for decreased specialisation alongside increased professionalism. He would, for example, like to see an intern system for engineers similar to that in medicine. Part of the difficulty in establishing such a thing is the lack of a system of professional licensing for engineers, which means that it is not easy to press for higher professional standards. His dual training in engineering and law has recently taken John into courts as a professional witness, and he sees one possible outcome of the growing number of law suits being filed against engineering companies for such things as design faults, being the kind of professional organisation that might make it possible to enforce higher standards. While he is committed to the development of professionalism amongst engineers, this does not necessarily imply specialisation, just as the country doctor may be no less professional than the brain surgeon.

As for decreasing specialisation, John prefers to work in a small company, "where you can see the design through to the finished product," and compares his situation favorably with that of a colleague who works for Lockheed in Atlanta.

> *He'll spend perhaps a year designing one bolt to hold the tail flaps of an aircraft he'll never see. Here I may be the only person who knows what the finished thing will look like. That brush cutter we were looking at--that's my baby. When we built the prototype I was down on the shop floor with a wrench in my hand. And when we went out into the woods to test it, I went too. Doing that you often see things that are obviously wrong or badly designed, but which you wouldn't notice just sitting at a drawing board.*

Of course there are constraints, some of which would no doubt overwhelm the academic or large company director. The plant has no facilities for metal casting or for working with glass fibre or plastics, and John talks enviously of the computing facilities available in some places. Yet he sees constraints, even severe ones, as the essence of the design engineer's job. "That's what the job is. Working within the limits of the situation and producing something that works even if it isn't the ultimate machine."

Talking as an engineer, his main criticism of education is that it is too often theoretical and academic, and not concerned enough with the value questions and the social and environmental considerations which he feels should be of greater importance to anyone working in the applied sciences. Most of this criticism is aimed at college level education, but he'd like to see the schools operate with more of a problem-solving, or project-based approach, once students have acquired the basics. He is aware of curriculum experiments along these lines, but feels they have had very limited effect outside a few well known schools.

John is strongly in favor of the introduction of widespread metrication, and feels it should be done suddenly rather than gradually, for "in the long run a rapid change would be easier." He quotes the example of when Denmark changed from driving on the left to on the right. "They closed the roads for two hours, and then at midnight everyone changed over. It was the only way to do it. That's the way we should approach metrication. It would be better in the long run."

As An Employer

The company, like many companies in the South, lives with the advantages and disadvantages of being non-unionised. The main advantage that John sees is not in terms of lower wage rates, but in terms of the flexibility of labor. Men can be moved from one job to another when there is a rush to complete an order, and as an engineer he, too, can get his hands dirty when it seems necessary ("in a union plant they wouldn't let me lift a wrench"). The biggest disadvantage is the availability of a ready pool of skilled labor. The turnover rate is low and many employees are part-time farmers (working hours are 7:00 a.m. to 3:30 p.m., so that they have a few hours daylight after work). But welders especially tend to be transient workers and are often hard to recruit. The state runs courses to try to meet demand, but this requires a degree of long-term planning the economics of the industry rarely allows.

More generally, John feels that there are deep-seated trends that perhaps the education system should address. Like Mr. Ward, he is concerned with the schools as a source of attitudes toward work. To some extent this is revealed in his view of the professional engineer; but he also has strong views about craftsmanship:[3]

> *I regret that we have lost respect for the craftsman in America. At home I have a family Bible. It was the first Bible printed in America, in 1790. At the back there is a list of the names of the people whose subscriptions made the edition possible. First there is "George Washington, President." Then follows a list of people who were "sailmakers," "cabinet-makers," "shipwrights," and so on. It seems to me that people were proud of what they did then, and they used their craft like we might use our degrees or professional qualifications. In some ways I regret that change. If my son says to me: "When I graduate from high school I want to be a machinist, and I don't want to go to college!" I don't think he should feel ashamed about it, nor should I. But that kind of change in attitude seems a very difficult one to make. Inside schools or outside there seem to be a lot of pressures on the old idea of craftsmanship.*

Pecan County is still far enough from contemporary industrial society for people to remember the old values. People repeatedly referred me to the Foxfire books, and sometime during my stay in the area I came across some reference or evidence of most of the skills these books describe. Many people shared the misgivings John Stephenson so eloquently expressed of an attitude toward life that scarcely survives in these days of interstate highways, television and supermarkets. Children, too, seem deeply conscious of the past. One junior high school student told me his favorite school subject was history, and his favorite TV programmes, "The Waltons" and "Little House on the Prairie:"

> *I'm just real interested in the old days. I like to talk to my Granny about the old days and how things were. How they used to walk five miles to school, and what they used to eat and what they used to wear.*

Paradoxically, nostalgia for the pioneer past seems to make it easier to forget the more recent past, pre-Civil Rights, adding a twist to William Faulkner's comment that, "in the South the past is not dead, in fact the past is not even past."

It seemed to me that it was often the people who expressed a feeling of loss about the past who were in some way at the current cutting edge of the society. John, the industrial engineer in a rural area, was one. The junior high school student who avidly watched "The Waltons" was another. A black boy who lives "out in the woods" all the year but who spends the summer with his sister in New York City. His adolescent experience is probably beyond the imagination of most of us, not only many of his teachers.

On John's point about the decline of craftsmanship, it is important to note that many who share his concern feel the argument is economic as much as social. There is considerable public concern about the cost of higher education at state level. The injection of state money has created an expansion of institutions that has had considerable effect on those towns blessed with universities and colleges. However, questions are now being raised about the educational quality of many of the courses. In a state where only some 20% of the high school graduates proceed to college there might seem to be room for expansion; but there seems at present to be considerable concern about the high cost of a system which, as one person put it, "produces PhD's in Home Economics who can't bake cornbread." The competition between the public schools and higher education for funds was, during the period of the study, beginning to emerge as a crucial issue.

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[3] However hard I try, I cannot bring myself to write "craftspersonship." Any alternatives would be welcome.

As A Parent

John has two children in the city public school system. A boy in seventh grade, a girl in fourth grade. On the whole he is impressed by the quality of the schooling they receive:

> *I am especially impressed by the new math they get. My kids understand the basic number system much better than I ever did at their age. They understand about tens and units and they know for instance what multiplication is, rather than just knowing some tables by heart. In the long run I'm sure this will be a big advantage to them, especially when they come to take algebra or calculus.*

John sees the math program as an acceleration of the curriculum he received at school rather than fundamentally different in kind:

> *In the seventh grade they are considering unknowns, exponentials and basic geometry. Even in fourth grade they have done equilateral triangles--concepts I didn't meet in school until the tenth grade.*

He sees one reason for this in the improved training of math teachers. "When I was in school it was always a joke that the physical education teacher or the coach taught math in his spare time. It wasn't really taken seriously like it is now."

One thing that does trouble him is the ease with which he sees his son turn to the pocket calculator. ("I hate to see them use it so early.") The danger is that children will stop thinking about the processes involved. He would much rather they were taught to use a slide rule before going on to the calculator. "With a slide rule you've got to know where you are and what you are doing. You've got to have a rough idea of the answer, if only to place the decimal point. And as you operate it, you can see what you are doing and how some of the things work: in the addition of logs, for example. It's not a black box like the calculator."

This response might seem strange from a practising engineer whose working day involves some dependency on the calculator, but John sees a clear distinction between the world of school and the world of work in this respect:

> *Here, the answer is important. I have to be sure I have it right. In school, getting the right answer is secondary and less important than how you got there.*

As A Teacher

John offers another perspective on the educational scene because he is also a teacher. Each morning he teaches a class in basic engineering to plant employees, but in addition he teaches math, and sometimes science, at junior college night school classes.

He feels confident teaching math. The course is "basic and organised around what people want to know rather than around a textbook." Biology he found rather more difficult. "The courses have changed so much since I was a student. I don't think we went much beyond the cell at high school, but now my son in seventh grade knows all about mitochondria and the finer structure of the cell." Nevertheless, the course did give John the chance to try relating science to day-to-day things. He felt many of the students didn't realise how immediate science is to much of their daily lives; instead they saw it as distant, abstract and difficult. He gave the example of local concern over a plan to introduce chlorination of water supplies. John explains, "There was a lot of confusion; people didn't understand such things as the relationship between chlorine and ordinary salt. They thought, 'Chlorine is a poisonous gas, someone is trying to poison us all.'"

Summary

Like Preston Ward, John Stephenson sees the school's role as critically concerned with developing certain attitudes and values amongst students, rather than as concerned with a purely instructional process. At this point their views probably diverge; Mr. Ward seems to be looking to the schools for people who can apply themselves persistently to routine, if difficult tasks. John Stephenson, on the other hand, seems to be looking to the schools for people who will question what they are doing, not simply in terms of means, but also in terms of ends.

Perhaps the major problem met by the school curriculum as it attempts to move from instruction to values is how to cope with the values of a society increasingly conscious of its pluralism. How far the views represented by Mr. Ward and Mr. Stephenson are compatible, and how far they conflict, is not only a question for the schools, but a question of more general significance. Should schools be concerned with meeting the kind of labor needs a plant like Mr. Ward's demands? Should they attempt to raise the aspirations of students, knowing they will be compromised? Or should they forget such questions altogether and just get on with the business of teaching?

These questions, which raise themselves in the gaps between the world of school and the world of work, are perhaps amongst the most critical curriculum questions of all. They are not questions that can be answered within any one curriculum area, any more they can be met by the schools alone.

IF ONLY I'D HAD MORE TIME

As a family we enjoyed our seven-week stay in Pine City immensely; but there's a lot I didn't get to see, people I didn't get to talk to, classes I didn't get to visit. Some of those I did get to don't figure in this report when perhaps they should.

The biggest gap is the elementary schools. I spent most of my time in the high schools because that's where I started, and even after six weeks there were still things I wanted to do. Nevertheless, some of the most interesting and the most skillful teaching I saw was in first grade. It doesn't figure here because I ran out of time and space and found it difficult to organize within the format of this report. It doesn't mean I don't think it was important.

The same is true of those teachers who let me into their classes but who are not reported here. Their omission might be perceived as criticism or as a slight. It isn't intended to be. I value what I saw in their classes just as much as what I report, but in trying to compress everything into a manageable space I chose to sacrifice coverage for detail. It was almost chance who and what was included and what was excluded. If I were to do it all again, it might come out differently. . . .

ROB WALKER

Currently a lecturer at the University of East Anglia, Rob Walker is a former teacher for the Inner London Education Authority who has also been a research fellow with the Centre for Science Education, Chelsea College, University of London, and a lecturer at the University of Keele.

His research has included work in the fields of pharmacology and sociology, as well as in education. Other projects in which he has participated include the Classroom Research Project at the Centre for Science Education, Chelsea College (1970-72), and SAFARI (Success and Failure and Recent Innovations)--a project affiliated with the Centre for Applied Research in Education at the University of East Anglia (1973-76).

Rob lives in Norwich, England, with his wife, Lynne, and their two children. As the accompanying photo reveals, he has a penchant for highly symbolic behavior and totally lacks a sense of humor. His publications include Guide to Classroom Observation (with C. Adelman, 1975) and Changing the Curriculum (with B. MacDonald, 1976).

Chapter 7

THE STATUS OF SCIENCE, MATHEMATICS AND SOCIAL SCIENCE IN WESTERN CITY, U.S.A.

Rodolfo G. Serrano, Ph.D.
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Bakersfield, California

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Western City in mid-California is a center of agribusiness with a considerable proportion of its population engaged in "agriculture and trades." The California city which Rodolfo Serrano portrays is not the progressive and thriving California of the sixties. Instead, it is a city with the same decay and decadence plaguing so many cities of the seventies. The hip California culture is not as visible as "country and western" culture, but the city is not homogeneous. It features diversity partly because of large Black and Chicano populations.

The schools studied--chosen from a K-8 district of all elementary and junior high schools and a high school district of seven high schools --were two junior high schools, several elementary schools and one high school. In nearly all the schools described, Anglo students accounted for only fifty percent or less of the student body. The dominant minority groups were Chicanos and Blacks. Serrano portrays these schools as rather bleak places for children; his tone is despairing. The problems of the schools include limited resources, lack of articulation, lack of parental involvement, and the encroachment of problems from the "outside world." Some of his conclusions are that the schools are reeling from desegregation, producing illiterates in science, lacking articulation and supervision, and declining in enrollment and resources.

The schools, in turn, are trying to cope with the realities of urban neighborhoods which are not only culturally diverse, but are also locked into the cycle of poverty. Graduates from this district, as members of minority cultures, are likely to be assigned unskilled labor positions. Only two percent of the students go on to college. Serrano ascribes this result to the "culture differences" students experience in the schools. Reflecting his ability as a documentary filmmaker, he provides through his choice of details a vision of the city, its neighborhoods, and the impact of cultural diversity on the schools.

THE STATUS OF SCIENCE, MATHEMATICS AND SOCIAL SCIENCE IN WESTERN CITY, U.S.A.

Rodolfo G. Serrano

BACKGROUND

Western City is located in a rich agricultural area that produces a variety of crops throughout the year. Although its climate is mild and lacking in rainfall, Western City has become the center of large corporate agribusinesses in its part of the state; and these corporations have taken over, to a large extent, the development of the rural areas of the city. Their control of the water in this locale--by way of controlling water rights--has made them a powerful force in the control and development of this area.

This control extends, also, to the several smaller hamlets, averaging 15,000 in population, which surround Western City and which are also heavily dependent on agriculture and Western City for their survival. The uniqueness of these smaller cities, though, is in their contribution to the overall productivity of the area. Some of these towns are noted for their production of oranges; others for their production of potatoes, onions, almonds, cotton, grapes and the like.

Western City has a population of approximately 184,000. The ethnic makeup of the community is approximately 74% Anglo, 16% Mexican American, 8% Black, 1% Oriental, 1% other (July 1, 1976). These numbers are significant because the labor force for Western City and its agribusiness comes from these groups (especially field labor). Accordingly, the government and the general services areas employ approximately 37% of the work force while agriculture and the trades employ approximately another 37% of the labor force. In Western City, where the ethnic population is 26% minority (non-Anglo), most of this part of the population is engaged in field agriculture-related activity. For a general population that has a 12.1 median grade level attainment, the ethnic minority membership has a grade level attainment of 8.9 (based on Twenty Key Census Tracts for the Greater Western City Area). Also important to the economy of Western City is the oil industry and its related services. The economic contribution of this industry is not to be underestimated, though as a driving force in local government and the schools, its influence is a matter yet to be determined.

The city itself is also noted for its country and western type atmosphere. It attracts country and western singers and other related activities such as the rodeo. The community as a whole supports these activities, and it is not uncommon to hear such expressions as:

> *"Once an Okie, always an Okie."*
> *"What's wrong with being Okie?"*

Country and western singers are abundant in Western City, and one of the main attractions is a nationally known TV celebrity who resides there. His contributions to the overall development of Western City are not to be minimized, because he has brought the city national exposure.

The importance of the makeup of the community--Western City--is that the problems that develop because of such diversity inevitably have a tendency to make their way into the public schools. This is evident by way of the de facto segregated schools that still persist in the community, the heavy preponderance of ethnic minority members holding unskilled labor positions (agricultural field hands), the problems related to cultural differences experienced by some of the students in school, etc.

THE PURPOSE OF THIS STUDY

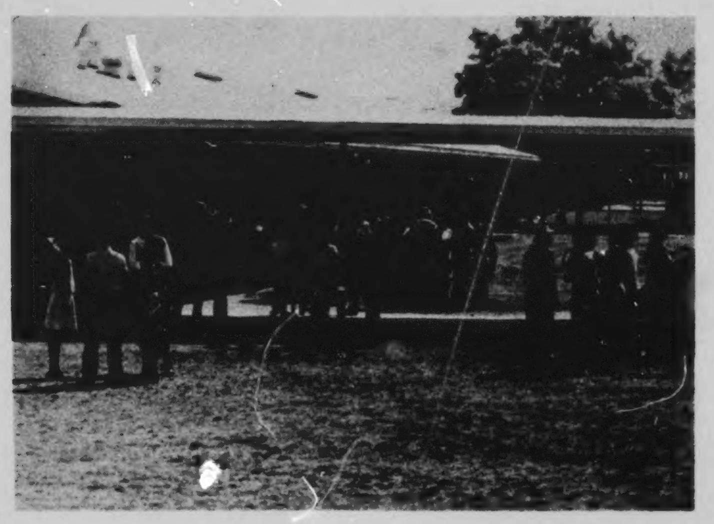
For the last five months, Western City has been the focus of this investigation. In particular, it has been the intent of this investigation to determine the status of science, mathematics, and the social sciences in the public schools in Western City. The procedures followed in this study included the method of the anthropologist--participant observation--as well as the method of secondary analysis. Many trips were made to selected public schools, including elementary, junior high schools, and a high school. Classes were observed while in operation; discussions were held with students, teachers, and administrators; and interviews were also conducted with students, teachers, and administrators. Analyses of other studies conducted in Western City were made, as well as analyses of census reports and other documents available, that provided information on the characteristics of Western City. It was the compilation of these data that made available the resources necessary for this report. What follows, herein, is a synthesis and an analysis of these data.

THE SCHOOLS IN WESTERN CITY

Educational policy is determined by two separate school districts in Western City. Western City School District (W.C.S.D.) establishes policy for the grades K-8, while the Western City High School District (W.C.H.S.D.) operates the education system for grades 9-12. The W.C.S.D. enrolls approximately 18,400 students in its thirty-six elementary and junior high schools. The district employs 867 teachers (including counselors), and 77 administrators. The numbers do not include those administrators who perform their duties out of the Superintendent of Schools' office. The W.C.H.S.D. enrolls approximately 18,800 students in grades 9-12. The district administers twelve high schools within the county--eight of these schools are found within the city boundaries. The district has 803 teachers and 135 administrators under its employ.

Within the city boundaries, the W.C.S.D. has thirteen elementary schools, of which six took part in this investigation. These schools were located close to the center of the city and were selected because of the close ethnic approximation to the rest of the city. They were also selected because they were identified as feeder schools to two of the local junior high schools.

The two junior high schools selected to participate in this investigation were similarly identified; i.e., proximity to the center of the city and feeder schools to the most central high school. Junior High School I was located in a southerly direction, while the Junior High School II was located in the "Heights" (northeasterly) area. Junior High School I is located in a predominantly Black neighborhood while Junior High II is located in a predominantly Chicano area.



Junior High School I - break between periods

Junior High School II - break between periods

Western City High School is one of seven high schools in the city. It is located near the center of the city and receives its largest number of students from Junior High School I and Junior High School II. W.C.H.S. is located in contiguous fashion to Black, Chicano, and Anglo neighborhoods.

Western City High School - changing classes

W.C.H.S. was the only high school in the city for a number of years and until recently (1956) was used by the junior college district for its classes. W.C.H.S. is a proud school: it claims among its alumni a number of athletes who have made it to the professional ranks, movie stars, television celebrities, well-known medical doctors, university professors, and men in high state and federal governmental offices. Community members, at times, refer to W.C.H.S. as a sister institution to the junior college, not realizing that the high school is in a totally different school system. The relationship between the junior college and W.C.H.S. is a close one, particularly when close to 47% of its graduates matriculate to the college. During the fall of every year the significance of these figures becomes apparent when the names of football players who used to play for W.C.H.S. are now heard playing for the junior college. As in any community, when there is a rallying point, the community as a whole is quick to defend "its" team and "its" players, regardless of color of skin, cultural identity, or place of origin.

The Elementary Schools

The elementary schools that participated in this study were selected primarily because of their ethnic composition, their proximity to the junior high schools, and their geographical location with respect to W.C.H.S. On the average, their student body enrollments were approximately 530, with eighteen teachers, fifteen teacher aides, one teacher counselor, one counselor, one curriculum specialist, and one principal. The ethnic distribution for the schools was approximately 56% Anglo, 40% Chicano, 3% Black. The enrollment pattern that persists is one of "no growth" or of a slight decline. This is attributed by school authorities to the slack in birth rate. In any event, school enrollments are relatively steady at Western City.

The Science Program

The science program in the elementary schools at W.C.S.D. is almost non-existent. The inclusion of a science program, like any other program, is left in the hands of the building principal. If the principal decides that the program is important enough, he/she can decide to include it as part of the school curricula. The pattern found at W.C.S.D. is one in which most building principals find themselves limited as to time because of governmental (state and federal) impositions placed on their programs if they receive state or federal monies. These impositions include time limits (100 minutes) placed on physical education and/or required time allocations needed for the other twenty some-odd areas of study, including science education. (Please see comment of Director of Instruction, page 7-39.)

Building principals are also constrained by the amount of time they have to allocate to testing. This testing is performed in order to satisfy federal, state, and local requirements. Again, this comes about because: (1) it is dictated by the agency that provided the monies; (2) to insure that the monies will be forthcoming, efforts have to be made to show the authorities that the money is needed; and (3) it must be done in order to satisfy the local school board that things are being accomplished by the schools. This last item is not very often undertaken; but when it is, it is found to be time consuming. As one principal explained:

> . . . *It gets to the point where you can't do very much. If you're not getting it from the State, you're getting it from the "Feds." We just don't have enough time to do all the things we would like to do. You have to establish priorities.*

One of the concerns expressed by some principals now involves bilingual education. The state-ordered plan that directs all school districts in the state to develop bilingual programs where there are fifteen or more youngsters who do not speak English is seen as infringing on the time now allocated to other subjects. One principal stated it in this fashion:

> *If you start with one language, where will it end? There are so many languages that people speak around here. We have Basques, Filipinos, Native Americans, Germans, etc. Where are we going to get the teachers to teach these youngsters? It's insane to ask the schools to do all of these things.*

The problem is a real one that needs to be addressed soon. It does seem plausible, however, that if bilingual teachers could be found, the curricula and the various and sundry programs could be handled in the foreign language of the youngster (in this case, Spanish). This is a much larger problem that needs special attention in order to establish any modicum of satisfaction.

While time is a critical factor in the implementation of the W.C.S.D. curricula, the faculties at the various schools are also harried by the various teacher organizations throughout the year. "If it isn't pay schedules, it's textbooks; if it isn't programs, it's class size . . ."

> *We have been negotiating salary contracts with the district [elementary district] for a long time and seem to be getting nowhere. If a strike is what they want, a teacher strike is what we will give them. . . . We*

> *aren't asking for something beyond the means of the district . . . we only want a salary and working conditions that are appropriate to our jobs . . . (Teacher Comment, 1977).*

Similarly, mandatory meetings, parent-teacher conferences, and professional organization meetings take a considerable amount of time from the teachers. The little time that is available most teachers would prefer to have to themselves:

> *By the end of the day, I'm just pooped! Having to run off some papers and get the class ready for the following day, doesn't give me enough time. Then teaching all those kids all day long is hard. By the time you think about the things you have to do and the next day . . . it's time to start all over. There just isn't enough time during the day to get all things done I want to do (Teacher's Comment, 1977).*

As a consequence of all these time constraints, the science program at the elementary school level in Western City is almost non-existent. This is somewhat surprising because in 1972-76, the local state university initiated an NSF Elementary Science Project for teachers. (Please see comment of Director of Instruction, page 7-39.)

> *Nearly 300 individuals from schools in . . . the county participated in some way in the various projects during the four-year period 1972-76. Many of the teachers were involved in more than one project (ESS, USMES, SCIS, ISCS). Included among the 300 participants were 65 administrators who had directly or indirectly been associated with various aspects of the project (State College Document, 1976).*

> *At the time we sent one teacher from each school and the principal. Schools chose the particular science program they desired and this was purchased for the school; S-APA for most, U.S.M.E.S. for a few. Six junior highs were supplied with S.C.I.S. laboratories.*

> *It undoubtedly is true, in terms of priorities, that schools pay less attention to some areas of the curriculum than others. When trying to implement all that is to be taught in a 230 minute day (first grade) to a 300 minute day (sixth grade) and a little longer (seventh & eighth grade), it does become difficult (Administrator's Note).*

For various reasons the elementary schools appear to be giving up the science programs that numbers of them had established a few years earlier. In particular, it appeared as though E.S.S. (Elementary Science Study), S.C.I.S. (Science Curriculum Improvement Study), and S-APA (Science - A Process Approach) were programs that were going to unfold and blossom. But this was not the case as evidenced by this study. Of all the schools visited, five years after the state college project was started, there was only one school that was utilizing one of these programs. In this school the S-APA program was being used on a one-semester basis--and only in a modified form. The teacher explained:

> *The children in grades K-2 receive twenty minutes of instruction a week. Third graders receive two hours per week of instruction. The fourth, fifth, and sixth graders receive five hours of instruction every third week.*

When asked about the success of the program, he stated that he thought the program was very successful. Even for such short periods of time, he thought the time was well worth the efforts. The "kids seem to enjoy it and they get excited about coming to science class," he stated.

> *The second grade students that were observed in a morning session appeared eager and interested in their assignments. They came in from an adjoining room and quickly went to the tables that interested them. The teacher gave them instructions and told them not to bunch up on any one table. One of the tables had a variety of materials to be weighed on a beam balance and*

> *the students went right to work. Other students worked on puzzles and similar type games. All during the science session a variety of behaviors were noted, but my overall impression was that the students were interested and appeared to be having fun (Field Notes, 1977).*

In this school where the S-APA program is used the most "extensively," they also have the problems of time allocation for the various curricular offerings. The reading program, the multicultural components of the early childhood program, and the numerous interruptions due to testing evidently do not interfere with the inclusion of elementary science at this one school. The school populations are slightly different, but the time schedules are basically the same. It would seem, then, that other schools should be able to follow this lead.

Mathematics and Social Science

Mathematics at the elementary level varies from school to school. Some schools use packaged programs such as the C.D.A. (Curriculum Development Associates), while others rely primarily on work problems on dittoed sheets. A large number of teachers prefer to "scramble and choose" those materials they think would be most beneficial for their students. As a consequence, unless the teacher has a few years of experience, a good amount of time is spent hunting for appropriate materials for the students.

From the state level, testing is required of all students. In some cases testing of the students is performed two and three times a year, particularly at the fourth, fifth, and sixth grade level, and this again is very time consuming:

> *The students have to be prepared before the test, well in advance. None of the schools want to come out with low scores. Low scores would mean that we have not been doing our job (Teacher's Comment, 1977).*

The pressure for high score attainment is real in the W.C.S.D. The schools in our sample reflected this pressure; yet there was little, if anything, the teachers could do to eliminate this undue pressure for higher scores that would indicate high achievement in mathematics.

Yet achievement is not high; at least, not consistently so. Of the three main ethnic groups in the W.C.S.D., the Chicanos are the ethnic group that exemplifies the loss of mathematics achievement. By the end of the sixth grade, the Chicano group is reading almost two years behind grade level and is over one year behind grade level in mathematics. Whether this is due primarily to language difficulty is not known, but there is some evidence that indicates part of the problem:

> *. . . just arrived from Mexico. We have him sit over there because no one can understand him. He hasn't learned to speak English yet. When he gets to the point where he can understand English, we will start him on math and some of the other areas . . . (Teacher's Comment, 1977).*

While variation exists from school to school in mathematics instruction, the situation for social studies is even more pronounced. In social studies there appears to be no commonality of subject matter content utilized in any of the schools. The materials used vary with every teacher. When asked about this particular area, most teachers responded that this is one area that is dealt with only tangentially. They are not concerned with this area of science per se because their concern is more with reading, writing, spelling, arithmetic, and art.

Most classrooms display a large variety of posters, pictures, and other colorful materials. These materials are usually found on the bulletin boards and on the walls. Most of them carry a message that in many instances might be hard for young children to grasp:

> *In one classroom there were a number of magazine pictures depicting life in India. Some pictures were of young children playing in a field. Other pictures illustrated Indian architecture and street scenes. Of what benefit could these be to young children (third graders)--without introduction or some semblance of how they fit into the program? (Field Notes, 1977).*

Text materials in the social sciences for the first three grades are not available as social science content material. If they were available to the elementary schools in Western City, none were seen being used. The only materials in this area that were being utilized were weekly publications that were intended for the reading area but were being used in conjunction with social studies. In grades four, five, and six, the emphasis was not observed to be much different from that observed in the early grades.

The final authority for the school curriculum in Western City rests with the local school board. The building principals, then, have a tremendous responsibility in assuring the district that a reasonable curriculum is being implemented. All the teachers, in short, must follow a plan that will insure "success" in their respective classrooms. Thus, the selection of qualified teachers is important to the principal because they are the people who carry out the planned curriculum. Any breach of trust between principals and teachers could result in programs that might not be successful in meeting the needs of the students.

> *. . . There is a board adopted course of study which outlines what is to be taught in all three areas of study. . . . Also for each grade and subject there are curriculum guides which the teacher can use to implement the course of study and the instructional materials. The state laws . . . mandate that each elementary district adopt such a course of study. . . .*
>
> *Principals are reminded at meetings throughout each year that this is a requirement. As each area of the course of study is revised (by committee) it is sent not to the district at large . . . the document is sent to the board for adoption.* (Please see comment of Director of Instruction, page 7-40.)
>
> *Curriculum guides are written by teachers' committees outlining the "what to teach" area, "ways of teaching it" and the various materials available to teach. These include books, maps, charts, films . . . listed in the curriculum guide (Administrator's Note).*

Parent-teacher advisory committees at the elementary level have very little if anything to say in the areas of science, mathematics, or social science. While most parents are concerned about their children learning math and science, parents in the W.C.S.D. accept what the teachers are willing to do in these areas. The parents are consulted only superficially for their advice on curriculum matters through the P.T.A. and other advisory bodies. Their "input" into policy making decisions is next to non-existent.

The Junior High Schools

Two junior high schools from Western City were selected for purposes of this study. Their geographical location and their student populations were key considerations in their selection. Junior High School I (often referred to as the "Black school") is located in a southeasterly direction from the high school, while Junior High School II (the "Mexican school") is located in a northeasterly direction from it. While these labels do not truly represent ethnic distribution of the schools, that is the way to which they are referred by the population at large (Table 1).

TABLE 1

School Enrollment and Distribution of Junior High Schools I and II

	Junior High School I	Junior High School II
School Enrollment	483	606
Number of Teachers	26	29
Counselors	3	2
Principals	1	2
Clerical Staff	2	2
Ethnic Distribution		
Anglo	42%	41%
Chicano	16%	56%
Black	38%	2%
Other	4%	1%
	(Oriental)	(Native American)

The community around Junior High School I is predominantly Black with a few Chicano and Anglo families mixed in the neighborhood. The school itself is located directly across from a city park where drugs and marijuana are sold without difficulty. This poses a big problem for the school because the students are easy prey for the older teenagers and adults who frequent the park on a daily basis. As one of the teachers observed:

> *. . . That's why this school had to be fenced in. . . . There were a lot of trouble-makers and drug pushers very close by. They were getting so close that the problem was getting worse. Even now we find some of the younger people--some of our students--not only taking drugs or smoking marijuana but also selling it on campus. We have it somewhat under control now but the problem is still here.*

While the problems with drugs, marijuana, and glue sniffing are still around the school, by-and-large it is a healthy institution. Numbers of its graduates continue to high school and do very well--both academically and in athletics.

In contrast, while Junior High School II also has its problems with drugs, marijuana, and glue sniffing, they are not to the extent found in Junior High School I. The neighborhood around Junior High School II appears to be somewhat better maintained and is not surrounded, as is Junior High I, by public facilities that draw drug pushers and hang-arounds.

The Science Program

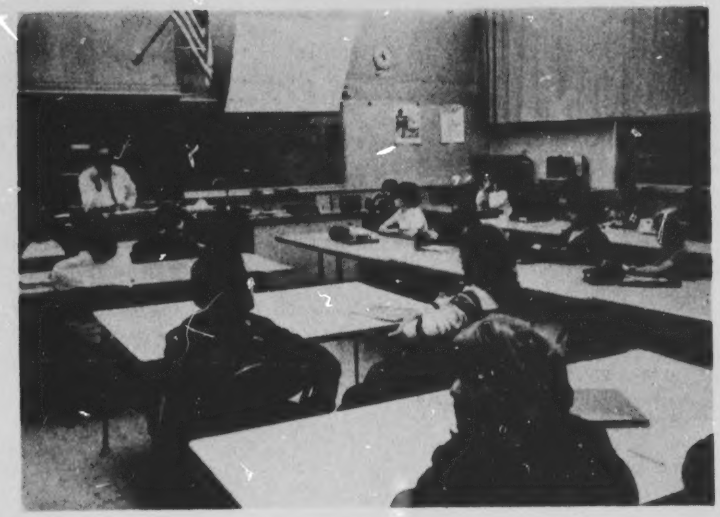
Science instruction at both schools is offered at the discretion of the building principal. If the principal has no interest in science, the science program at either school would fail to exist. As a consequence, the science program at both schools is a minimal program and is only as complete and thorough as the teachers who instruct in the program make it. The following observations (made during site visits) tell the story.

> *At Junior High School I, the "science room" is almost bare. There are some bulletin boards but they, too, have only a few items about earthquakes tacked on them. The storeroom is also badly supplied. There are three microscopes that are in semi-operable condition, a few unlabled chemicals, a few pieces of broken glassware (thistle tubes, test tubes), and a Fisher burner and a Bunsen burner. There is no evidence of any packaged kits (such as I.P.S. kits) or other pieces of equipment that would indicate that the students would have some experience with hands-on equipment. The science room has desks and only a few tables are available in the room. The principal is making a great effort to upgrade this area.*
>
> *The "science room" at Junior High School II is not in the same condition as the science room at Junior High School I. While the walls are still relatively bare, the closets are filled with I.S.C.S. (Florida State Science Program) packaged kits. There are ample supplies of glassware, hardware, and chemicals normally used in a junior high school science class. The collection of rocks and minerals is minimal, as is the preserved animal collection. Relatively speaking, the science room is much better supplied and organized at Junior High School II than the science room at Junior High School I.*

The science program at Junior High School II has been well established by the instructor (one of the participants in the State University Project) who has been at Junior High School II for three years. He follows a course of study that he has developed over the years and continues to modify it, utilizing I.S.C.S. materials as time goes on. His counterpart at Junior High School I, on the other hand, appears to flounder in the science area. At Junior School I, a considerable amount of time is spent studying earthquakes ("Since we live in an area that is earthquake prone, I feel the students should spend some time studying earthquakes"). Besides earthquakes, there is not much evidence of other science topics being discussed nor is there any evidence of students having an opportunity to get their "hands on" any equipment.

Because the science program at the junior high school level is left up to the individual schools and the respective science teachers, there is a wide range of areas and approaches that are used by the science teachers. Some science teachers in Western City have attended NSF institutes and are well versed in a variety of programs (I.P.S., I.C.I.S., I.S.C.S.), but do not use the materials exclusively. A great number of science teachers in the district are not aware of the existence of these planned science curricula and their packaged equipment and, as a consequence, do not use them. The following observations were made during the course of one week while visiting the schools:

> *At one junior high school, the science instructor is busily moving around from table to table talking to the students about the exercise. The lesson for the day has to do with the measurement of force. The students are supposed to come up with some idea as to how to measure forces (Figure 1).*



Junior High School II - a science lecture

Junior High School II - science students

Number of Sinkers	Distance Rubber Band Stretched (cm)
5	
4	
3	
2	
0	
1	

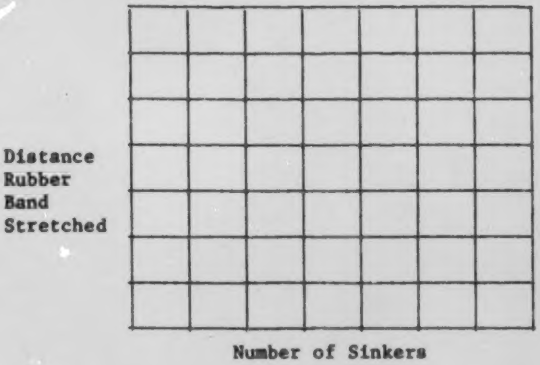


Figure 1. Measurement of Force Using Lead Sinkers and Rubber Bands

At another junior high school, the students are sitting at their desks listening to a lecture on nutrition. From time to time the class is admonished for not listening. On one occasion one of the students was severely reprimanded for chewing gum and given a lecture as to why gum chewing is not allowed in school.

At Junior High School I, the students are given an assignment. The assignment for the day is to copy the major geological fault lines that are found around the state. This is to be done by looking at the large map on the wall that was supplied by the State Department of Mines. A discussion of the distribution of fault lines was to take place towards the end of the period.

The teachers, when asked about their major concerns about the science program at their respective schools, responded accordingly:

Junior High School I

The students lack discipline. They make little or no effort to learn. They would rather talk and delay the teaching process. They are the ones that will suffer the most.

Junior High School II

The biggest problem at the school is absences. The students don't seem to care. They would much rather be somewhere else. Discipline is not as much of a problem here as is the lack of supplies and equipment. I always have to be on the lookout for equipment.

These expressed concerns by two faculty members from different schools are not necessarily the two most pressing concerns in the district. Other teachers in the same schools have voiced concern about such things as:

1. Lack of administrative support for their programs
2. Lack of supplies and equipment
3. The continued use of outdated books
4. Large classes
5. Lack of student motivation
6. Lack of parental interest in their children
7. Lack of adequate facilities in order to conduct their programs.

Also mentioned quite often were the lack of student discipline and absences from the classroom.

In the same conversations, when the science teachers were asked to describe a typical day in their science classes, the following is typical of the description made:

> *The kids come into class as soon as the bell rings. We check their homework (this is done for purposes of reinforcement). We present a short lecture (at least twenty minutes) on a given topic. We make an assignment for the following day. On Fridays, we schedule quizzes based on the last four days of work.*

It is true that the description above is a rough approximation of a "typical day" in a science class, but it is important to note that science teachers at both Junior High Schools I and II made approximately the same statement in response to the question about a typical day in a science class. Field observations would indicate that their descriptions are not far from wrong.

Junior High School II - science students

Finally, the extent of intra-school communication for purposes of sharing ideas with other science teachers and for purposes of borrowing or trading equipment is nonexistent in W.C.S.D. This is especially true of the science area. The specialist from the City Central Office makes little, if any, effort to call the science teachers together at least once a year. There are no in-service workshops offered by the City Central office and this in turn makes it very difficult to establish any dialogue among or between any of the science teachers in the district. This is true despite the statement made by one administrator:

> *Regular meetings are held with department leaders (formerly chairmen) by the Junior High School Consultant. These people . . . are responsible for assisting with curriculum in the various junior highs.*

When the question of articulation between the science taught at the junior high school level and the high school was raised, none of the science teachers remembered if a meeting had ever been held between the two groups. The specialist assigned to this area from the district level, it was determined, was apparently too busy doing other things more important than attempting to call a meeting such as this. The science teachers at both schools indicated that such a meeting would probably prove to be very worthwhile. In the meantime, it is apparent that the status of science at the junior high school level is at an extremely low ebb at W.C.S.D.

The Math and Social Studies Program

The mathematics program at W.C.S.D. is consistent throughout the city. All students are required to take math in grades seven and eight. The classes are "tracked" into three and at times into five levels, depending on the student scores on the C.T.B.S. (California Test of Basic Skills). Classes supposedly average better than thirty students, but field evidence indicates an average closer to twenty per class. (It is not determined whether this was due to absences only or whether it was a combination of absences and class changes.) (Please see comment of Director of Instruction, page 7-40.)

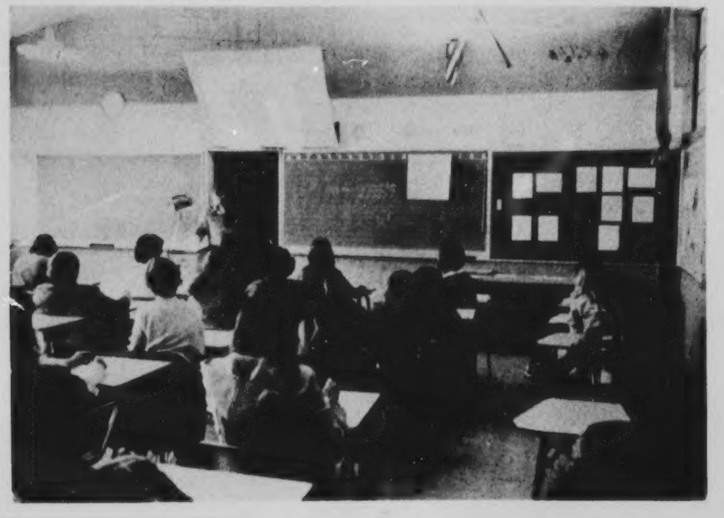
Since mathematics is a required class at the junior high school level, the schools normally have four or five full-time math teachers. Mr. Doe's classroom is a good example of what most math classrooms look like:

> *Mr. Doe has been at Junior High School II for six years. He transferred from Junior High School I and is currently teaching five classes of math a day. The class periods are forty-eight minutes long and this gives Mr. Doe an opportunity to try out different approaches in class. "His" room is neat and clean and what few posters, announcements, and papers are tacked on the bulletin board make the room look sterile. At the front of the room there is an opaque projector with pencils. To the side of the teacher's desk are two tables where reference books and students' papers are found. Alongside the north bank of windows is a counter that holds the students' books. When the bell rings fifteen minutes after the hour, the classes are ready to begin.*

Math instruction in W.C.S.D. also follows a common approach. As exemplified by Mr. Doe, the pattern of instruction is as follows:

> *The bell rings and some of the students run into class; other students drag in up to four minutes late, only to be reprimanded on the spot by the teacher. After some commotion, the class begins with Mr. Doe making a few announcements. Students are asked to pull out their homework and papers are exchanged. After twenty minutes of exchanges between teacher and students, the teacher announces the subject for the day. He presents the new material for fifteen to twenty minutes and then makes the assignment for the following day. The students commence working on the new assignment until the bell rings for them to go to their other class.*

This description is not an unusual situation. As typical days go, this pattern of class presentation was observed many times in mathematics classes in W.C.S.D. On occasion there were a few, but not many, classes where game-like activities were observed, as were some drill-testing activities. The most characteristic activity was the bookwork assignment at the desk.



Junior High School II - Mathematics class

W.C.S.D. provides a variety of materials for mathematics instruction. The texts most commonly used with the top level students (level one) include: Modern School Math by Dolciani, et al., and Essential Skills in Algebra by Dolciani, et al. For the lower level student (levels two through five), Mathematics Around Us (Holt, Rinehart, and Winston) is the text most commonly used in the schools. For individualized instruction the district provides the S.L.I.M. (Systematic Learning in Mathematics) packaged materials to all the junior high schools. Similarly, the district also provides a variety of mathematical games, math ditto masters, tinker toys (for geometry), and other reference books, in an attempt to provide for individual student differences.

Since the district provides materials for student use, there appears to be little, if any coordination between and among the junior high schools and the high schools. The one individual placed in charge of coordinating math and science activities is also responsible for coordinating all the other areas of the curriculum. The result is, that junior high school personnel never get to compare notes with each other; and similarly, they never get an opportunity to talk to the high school teachers about their program and the problems they face at the junior high school level. This lack of coordination and communication is a problem area that a few math and science teachers voiced some concern about in discussing their programs.

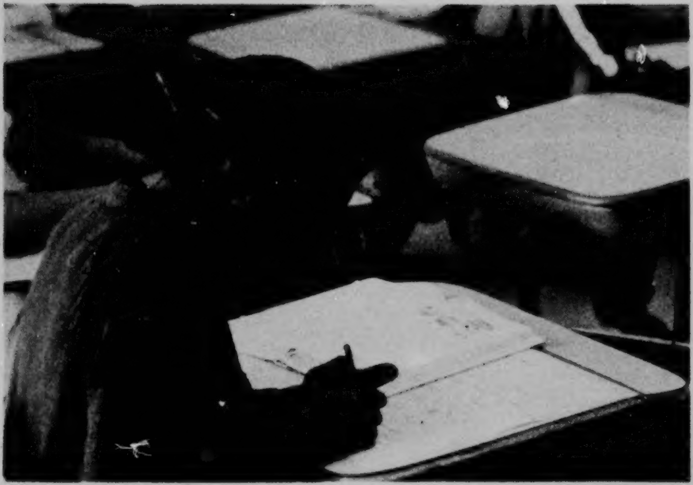
In the social studies area--G.H.C. (government, history and civics), as it is more commonly called in the W.C.S.D.--a great variety of programs exist. This is brought about because every student in school is required to take G.H.C. every year that he attends junior high school. Consequently, every school has fifteen to twenty classes of G.H.C. and there are approximately four full-time teachers involved in the instruction of G.H.C.

Junior High School I - mathematics class

The textbook materials most commonly used in the program throughout the district include the texts: Quest for Liberty (9th grade), We, the People (8th grade), and Exploring Regions of the Eastern Hemisphere (7th grade). The district also provides several other reference materials (mostly books) for the G.H.C. program. These materials, while they apparently serve the prupose well (most students graduate from junior high school), are also a major source of teacher discomfort. While some teachers complain about the level of difficulty of the texts, or that the materials in the text are outdated, others praise the texts for their traditional materials and the fact that students learn something from them. Generally, most teachers interviewed did not like the textbooks provided by the district for G.H.C. instruction.

Most teachers are also quick to point out that supplies are a "big problem."

> *The district doesn't give you any support. Most of the things you see in this room are things that I have bought. There are posters that I have had to buy myself with money out of my own pocket! Do you know that the district will not even buy a world map for this room? . . . A lot of these kids would do much better if we had (audio) cassettes and reading material dealing with people and events. You know that a lot of these kids can't read well-- a lot of them are reading way below grade level . . .*

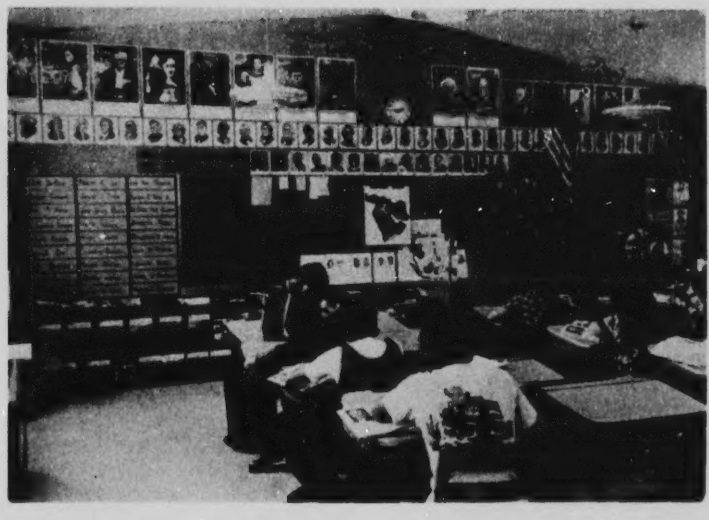


Junior High School I - mathematics student

Junior High School II - practicing G.H.C.

Junior High School I - reading G.H.C.

Junior High School I - doing G.H.C. homework



Junior High School I - a G.H.C. class.

There are a large number of teachers involved in the G.H.C. area, and instruction appears to cover the full gamut of approaches and methodologies. Some teachers are very didactic in their approach; others are very open and laissez faire in their approach to the subject. Those teachers who opt for the straight lecture-discussion method appear to have less respect from the students. Similarly, they are also the ones who have the most discipline problems, particularly from the ethnic minorities. At the other extreme, those teachers who attempt to individualize their instruction but still retain a little amount of lecturing and drill are the ones whom the students look-up to the most. As one student commented about a popular teacher who attempts to individualize instruction:

> *He's cool! He's not stuffy like some of the others. He lets you talk and likes to get discussions going in class. . . . He gives you work to do but it's fun . . .*

Other students have also commented on other teachers:

> . . .*He is a bore . . . all he wants us to do is to color the maps.*
> . . .*What I don't like is sitting and reading.*
> . . .*All we do it sit and watch films.*
> . . .*He is neat! We get to talk about what's happening in the world . . .*

The approaches to the subject matter, the methods used, the content of the course, are blended together by the various teachers in many different ways. Their success with the students is dependent upon a variety of factors, but one which readily stands out is the teacher's ability to communicate with the students at their level. This one factor predominates over all others including lack of supplies, outdated books, large classes, and lack of administrative support. The classroom atmosphere that is generated by a teacher who can talk to the students with empathy and understanding is very obvious, but not very catching. This is the case of one teacher in Junior High School I. The students greatly admire this teacher for his understanding and humor but they also work for him when he directs them to do so. The kinds of activities that he involves them in are also critical.

> *At one time Mr. Smith had some of his students working on locating countries on a map. Other students were working on reports that they were to give in class at a later date. Still another group of students was involved in reading some assignments they had missed. . . . The classroom had an aura of accomplishment. Something was happening and the majority of the class was involved doing something constructive for themselves or for the benefit of the class. Even the posters on the walls were colorful and drew attention.*

The majority of the teachers in the G.H.C. area are teachers who have been trained in their teaching area. None of these teachers has ever attended a National Science Foundation Institute in the social sciences to strengthen his or her background, but a large number are enrolled in the local state university and take courses in their field regularly. To what extent this aids (by providing newer methods, materials, knowledge) or hinders (by providing weak content and bad instruction) their instruction at their respective schools has not yet been determined.

With respect to parent participation in these areas of science and mathematics, it is safe to say that parents do not contribute to the development of any of the existent programs. Parent involvement in these areas was never observed nor mentioned during the course of this investigation.

Junior High School I - the library

The High School

Western City High School is located near the "downtown" area of the city. The south boundary of the school is a main cross-town avenue which is heavily travelled, especially during the morning and late afternoon commuter traffic. To the north are the railroad tracks, while immediately to the east and west are roads that carry very little traffic in comparison to the south boundary thoroughfare.

The high school is one of eight high schools located within the city limits, one of which is a private Catholic school. The two main junior high schools that feed into Western City High are the Junior High Schools I and II, although a few students from other junior high schools in the city do transfer into Western High.

The student enrollment at Western High numbers approximately 2,500 (February 1977), and has an ethnic distribution illustrated in Table 2. The distribution by sex is approximately even for the total enrollment, as it is for the various ethnic groups.

TABLE 2

Western High School Ethnic Distribution

Ethnic Group	Percentage
Anglo	52
Chicano	23
Black	21
Oriental	2
Native American	1

There are 122 teachers on the staff at Western City High School. The ethnic distribution of the staff includes 111 Anglo, 4 Chicano, 6 Black, and 1 Oriental teacher. The principal classroom assignments of the ethnic minority teachers are as follows:

Chicano Teachers	Black Teachers
Spanish	Social Studies
Industrial Arts	Counselor
English	English
Physical Education	Physical Education

Oriental Teacher

Social Studies

All of the teachers at Western City High are assigned to teach in their areas of specialization. On occasion some of the teachers are asked to handle assignments in the area of their academic minors, but these are relatively few. The school also employs twenty-five teacher aides whose main function is to help the teachers--primarily as tutors in the classroom. Most of the teacher aides are assigned to other than ethnic minority members.

> *Desegregation is an issue that is yet to be resolved in Western City. The elementary schools are under Office of Civil Rights investigation and, as a consequence, H.E.W. has stopped all new funding of federal programs. Recently, the W.C.S.D. filed a counter suit against H.E.W. and is waiting for a decision from the court.*

The administration at the school consists of one principal (who recently passed away and was replaced by one of the assistant principals), one vice-principal in charge of instruction, one vice-principal in charge of pupil personnel services, one vice-principal in charge of administrative services, six full-time counselors (two part-time) assigned groups of students according to their last name, and fourteen members of the clerical staff. The clerical staff handles duties that range from secretarial (secretary to the principal) to bookroom (student book assignment) management.

In sum, the administration and supportive staff are typical of the supportive staff found in any of the high schools in the Western City area. The number of aides that are employed to work alongside the teachers is a much larger group (at Western City High School) than is normally found in the other local high schools. This is sometimes viewed by the other high schools with jealousy and at times with an air of condolence: "They need all the help they can get."

The Science Program

The science program at Western City High School includes all the courses commonly found in any comprehensive high school. At the tenth grade, world science has been modified into eleven mini courses from which the student takes two for the semester:

- Human Biology
- Ecology
- Microscope and Water Study
- Home Plants and Gardening
- Astronomy
- Mechanics
- Chemistry
- Home Shelter
- Genetics
- Zoology
- Earth Science

Biology and chemistry are offered at the eleventh-grade level, while physics is available at the twelfth-grade level. All science classes are Western City High are tracked--in a modified sense: this is accomplished by imposing course prerequisities with corresponding grades. Most of the students at the school will take either world science or biology at the tenth-grade level. Either one of the courses will satisfy the graduation requirement.

Enrollments in science in general appear to be decreasing.

It has also been stated several times by different teachers and administrators that the reason for the decline was the increasing numbers of Blacks and Chicanos enrolling in the school. As Anglos have been leaving the neighborhoods close to City High ("white flight"?), Blacks and Chicanos have been moving in. This has had the general effect of decreasing scholarship and lowering of standards. Some teachers and administrators have also indicated that the situation will probably get worse before it gets any better. On the other hand, there is no evidence to indicate that this is really the case. The only evidence that is available is that there has been a steady increase in the number of ethnic minority members attending Western City High and an attendant decrease in science--chemistry and physics--enrollment. The local community college reports that while in 1967 the City High School matriculation rate to the college was 62%, the rate for 1974 was 47%. The community college also attributes the loss of enrollment from City High due to the end of the Vietnam War and other factors.

Despite the overall negative impressions, though, in the advanced science courses enrollments appear to be increasing slightly at Western City High. The following tables demonstrate the changes that are taking place at the high school.

TABLE 3

Subject Area Enrollments

Subject Area	Enrollments	Year
Science	924	Fall, 1975
Science	803	February, 1976
Science	855	Spring, 1977

The enrollments in Chemistry and Physics are indicated in Table 4.

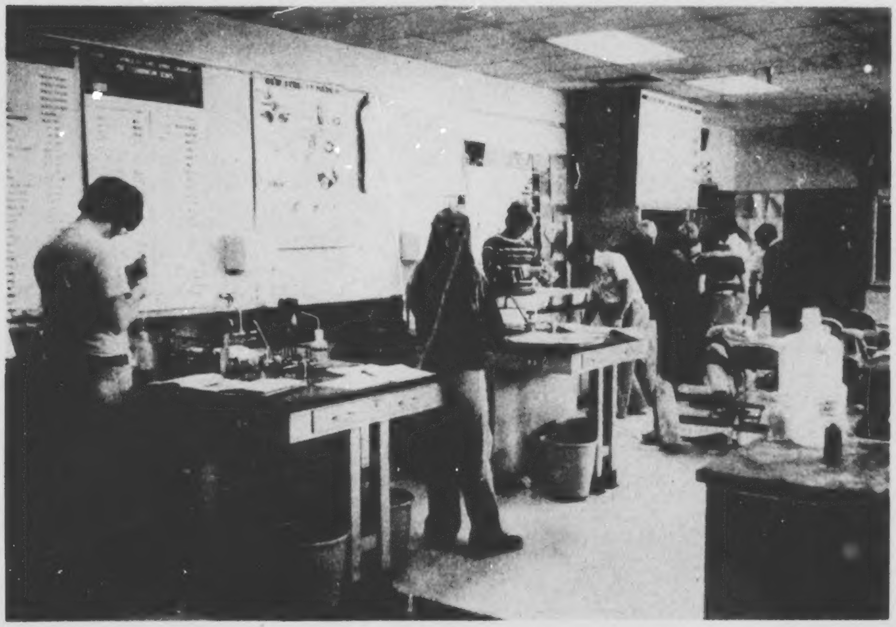
TABLE 4

Science Class Enrollments

	October 1975	February 1976	October 1976	February 1977
Physics	23	21	32	25
Chemistry	83	66	97	85
	(3 classes)	(2 classes)	(3 classes)	(3 classes)

The importance of these figures (for chemistry and physics) lies in the slight increase in enrollments after several years of decline. Although the "increase is very small," the "signs of change are appearing," according to the chairman of the department.

Enrollments in world science remain relatively large while enrollments in chemistry and physics are relatively small. There is only one CHEM Study chemistry class, three general chemistry classes, and one Harvard Project PSSC physics class at City High. In the CHEM Study class there are twenty-four students, four of whom are Oriental students (two boys and two girls), and no Chicano or Black students enrollment. In the physics class there are twenty-two students, four of whom are Oriental students (two boys and two girls), and no Chicano or Black students are enrolled. Of the twenty-two students in the physics class, nine students are female.



Western City High School - chemistry class

An indication of student interest and teacher response to students is indicated below. Also suggested is a positive effect on enrollments when staffing changes.

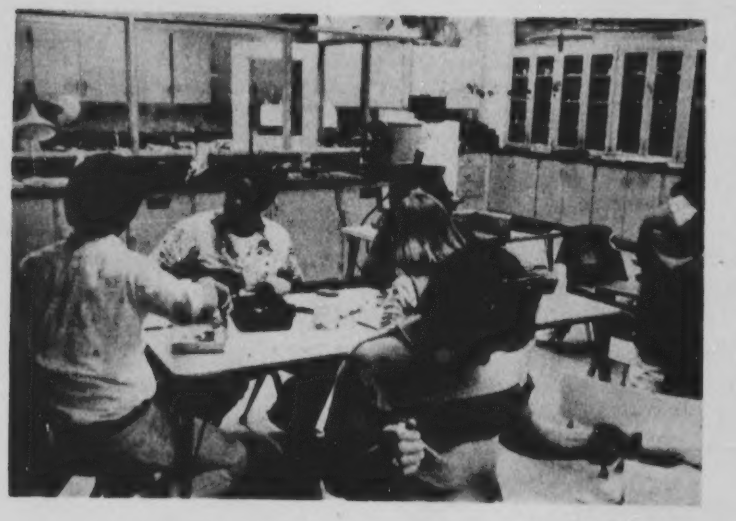
> *In one visit to the physics class, the class was performing a laboratory experiment. They were working with the ripple tanks studying wave reflections and refractions. The class appeared to be engrossed with what they were doing. When asked about the length of time they spent in the laboratory in any given week, most of the students responded that they spent at least one day per week in the laboratory. When quizzed about their reading assignments, they also appeared to be well informed about what they were doing and*

> *the theory behind their experiments. They were particularly complimentary towards their teacher, Mr. John. The class atmosphere was friendly and conducive to learning through "hands-on" experimentation. Mr. John, however, is leaving teaching at the end of this academic year. He is going to work for a private industrial firm.*
>
> *In one of several visits to the CHEM Study chemistry class the instructor, Mr. Paul, had invited one of the local state university professors to speak to his class. The professor was lecturing and demonstrating a technique used in the identification of certain benzene related compounds. During the demonstration, the students indicated enthusiasm and interest for the class and a concern for the health of Mr. Paul. The relationship that Mr. Paul has established with his students is one of understanding and willingness to listen to their concerns. Mr. Paul will not be able to complete the academic school year and his class will be taken over by a substitute.*

Western City High School - a chemistry demonstration

The faculty of the science department is composed primarily of male teachers. There is only one female member in the department and she teaches biology. The approaches used in the instruction of biology at West High are indicated from field notes:

> *Biology at City High is taught in the traditional way. The teachers prefer not to use the BSCS materials exclusively for fear that the students would not understand them. At one time, several years ago, BSCS materials were used unaltered, but since the student population has changed, the packaged*



Western City High School - a biology class

Western City High School - a biology class

> *materials are no longer used. The course in biology at City High resembles the old Moon, Mann, and Otto variety of the fifties. It is interspersed with some basic materials but only sparingly.*

Of the seven members in the department, only one (the chairman of the department, Mr. Paul) has attended an N.S.F. Institute (both a one-year and two-summer session institute). The other members of the department have not attended any institutes, although one member, the physics teacher, has a thorough understanding of the new curriculum and its laboratory orientation.

The science department at City High is well qualified to service the needs of the students in the science area. The lectures they present, the text assignments they make, and the laboratory sessions they conduct seem to support this contention. Most of the members of the department continue to present their subject in the "traditional" manner. Since very few of the faculty members are familiar with the more contemporary methods—the new science curricula—this might account for the little use of other than the traditional modes of science instruction at City High.

Western City High School - completing the report in science

According to some of the members of the science department, the biggest cause for concern within the department is student apathy. One member put it this way:

> *Students cut classes quite often and the administration doesn't seem to care. The classes meet only fifty-five minutes a day for four days a week with one day that floats. When you get students wandering around the hallways and*

> *out on the grounds at all hours of the day, you know the administration doesn't give a damn. A few years ago--in any high school--the administration would never accept this. But around here, hell, anything goes. After an absence, the students are supposed to bring a pass slip in order to get them into class. Do you know that half of those students don't bring a slip to class? You send them back to the office and--you know they were cutting class--they come right back with a pass in hand.*

The control against students' cutting classes or unexcused absences from class borders on no control at all. This concern was voiced by a large number of faculty members with greater frequency than was concern over supplies, equipment, or adequate reading materials. Student discipline and student lack of concern for the welfare of others is seen as a big problem at Western City High School, particularly by the members of the science department.

The following is a list of books used by the science department.

The World of Living Things	(10th Grade)
The World of Matter and Energy Brandwein. Harcourt Brace, 1964	(10th Grade)
Life Science - Challenge to Science Smallwood. McGraw Hill, 1973	(10th Grade)
Physical Science - Challenge to Science Williams. McGraw Hill, 1973	(10th Grade)
Earth Science Heller. McGraw Hill, 1973	(10th Grade)
Physical Science for Progress Pella. Prentice Hall, 1965	(10th Grade)
Modern Biology Otto and Towle. Holt, Rinehart, 1970	(10th and 11th Grades)
Interdisciplinary Approaches to Chemistry Chem. Assoc. of Maryland. Harper & Rowe, 1973	(11th Grade)
Chemistry Modules (7 modules) Devoe, et al. Harper & Rowe, 1973	(11th Grade)
Chemistry - An Experimental Science Workbook Pimentel. W. C. Freeman, 1973	(11th Grade)
The Project Physics Course Rutherford. Holt, Rinehart, 1970	

The Mathematics Program

In advanced algebra and trigonometry the enrollments appear to be on the decline, as illustrated in Table 5. The reasons for the decline are not fully understood, but some teachers have remarked that the reason is that the "overall ability level of the students at City High has been on the decline for the last several years," the implication being that the rise in Chicano and Black enrollment in the school is what has brought this about. One teacher stated: "These students are not interested in these areas of study! They are most interested in athletics and the arts."

TABLE 5

Mathematics Enrollments

Enrollment	Year
27	Fall, 1975
24	Spring, 1976
19	Fall, 1976
19	Spring, 1977

In the advanced algebra and trigonometry class the following ethnic distribution was noted: fifteen Anglo students; three Oriental students (two boys, one girl); no Chicano or Black students. In a general math class the following distribution was also noted: ten Anglo students, eight Chicano students, eight Black students, no Oriental students. These numbers are shown only to demonstrate the distribution of students as they are tracked into a program and to show the attrition rate noted during the course of the year. It is generally accepted at this school that the average class size is about thirty to thirty-two (peak average); but evidently absences, tardiness, and dropouts are a big problem at City High School because most of the classes observed had only twenty to twenty-five students in them.

Western City High School - advanced mathematics

> *In one math class observed there were twenty-four students present. The teacher made some general announcements and then proceeded to discuss the homework from the day before. Proceeding slowly with the explanations, the teacher repeatedly asked if there were any questions. After the assignment was corrected, the papers were collected. The teacher proceeded to explain the problems and their solution. The teacher assigned six problems as homework for the following day. Since there was a little time left in the period, the students were told they could start on their next day's homework assignment.*

At Western City High School, the total enrollment in the ninth-grade math classes is much larger than any of the other math classes. This is due to the fact that one year of math is required for graduation. Conversely, in the more advanced math classes, the enrollments are relatively low.

The faculty in the mathematics department is composed of fifteen members (ten males, five females). Of these, approximately six of the faculty members teach basic math (ninth grade), general math (ninth grade), or arithmetic (eleventh grade). Of the fifteen members of the department, two have part-time assignments in other departments. As a faculty, the members of the department are certified to teach in their respective areas. Two of the members of the department, including the chairman, have attended N.S.F. year-long and summer session institutes in mathematics. According to the chairman of the department:

> *The N.S.F. Institutes that I attended were well worth all the money. I'm sure that if I had not attended these institutes I would not have been able to do as good a job as I have done. I hope it's been good. A college graduate with a degree in math is not really prepared to teach high school. They don't teach you how to deal with kids and you also don't get much of a chance to get your head together with respect to math instruction. All math teachers should be encouraged to take an N.S.F. Institute at least every three to five years . . .*

While some of the members of the mathematics department at City High have had some acquaintance with "modern math" programs and contemporary teaching methods (student experimentation and individualized instruction), it is interesting that the approaches they take in the instruction of the subject have a tendency to fall back on the lecture--presentation, discussion, problem assignment, quizzing method. This is not meant to degrade the method but only to ask the question, why? Do the students find the contemporary teaching methods more difficult to work with? The majority of the members of the department appear to have had little introduction to some of the contemporary teaching methods and the conceptual schemes found in modern math. As a consequence, the forms of instruction observed in the math department at City High are characteristic of "traditional" methods and include many textbook assignments and classroom problems of the "drill" type.

The basic texts used by the department include the following.

Elements of Mathematics Cousins. Silver, Burdett, 1972	(Gen. Math, 9th Grade)
Modern Algebra Dolciani. Houghton-Mifflin, 1970	(Algebra, 9th Grade)
Modern Geometry Jurgeson. Houghton-Mifflin, 1965	(Geometry, 10th Grade)

Mathematics for Daily Living McCormack. A. Lewis, 1975	(Gen. Math, 11th Grade)
Modern Algebra and Trigonometry Dolciani. Houghton-Mifflin, 1965	(Algebra and Trigonometry, 11th and 12th Grades)
Modern Analysis Dolciani. Houghton-Mifflin, 1964	(Trigonometry, 12th Grade)

The chief concern of a large number of the members of the department includes the lack of discipline on the part of the students. "Students seem to have lost incentive in learning mathematics, abhor drill, and anything that requires work." Most students, according to a large number of faculty members, "do not seem to be motivated; they prefer to sit back and complain all the time." One student, on the other hand, commented:

> *Our teacher is very old. _____ has been teaching a long time. _____ knows her math but can't seem to explain it very well. The real top kids can understand it but the rest of us can't . . . They say this other teacher is also bad but Mr. _____ is good. They (the students) say he explains things and makes his class interesting (using a variety of materials). I hope I can get into his class.*

As for supplies and equipment, the members of the department generally did not seem overly concerned about this area. They all seemed to be satisfied with the amount and quality of the materials provided by the district.

The Social Science Program

The Social Science Program at Western City is one of the largest programs in the school, and is composed of the following courses:

California History	9th Grade
Geography	9th Grade
Current Affairs	9th Grade
Current History	9th and 10th Grades
World History	9th Grade
History	11th Grade
Current History	11th and 12th Grades
Government	12th Grade
Sociology - Economics	12th Grade
You and the Law	10th - 12th Grades
Business Law	11th and 12th Grades

The courses in the social studies department are not tracked per se; but (in ninth grade, for exmaple) most of the lower-tracked students are enrolled in geography and current affairs, while the higher-tracked students are enrolled in world history. By the end of their high school careers (graduation or withdrawal), most of the lower-tracked students will have taken only one or two courses in the social studies department, while the level four students will most likely have taken three courses (world history, history, and sociology-economics).

Western City High School - listening to a lecture on history

Because all students are required to take two courses in social science in order to graduate, enrollments in the department are inflated in the lower grades. But by the twelfth-grade level, for example, the enrollments in social science courses are relatively small. Many students even take government in summer school (between eleventh and twelfth grades). In one government class there were twenty-seven students observed (including three Black males and one Black female), while in sociology-economics there were only twelve students enrolled.

The perception that lower-tracked students take only the minimum number of courses in social science while higher-tracked students take more is not universally shared by Western City High administration, as the following statement by one administrator reveals:

> *All students take at least three courses--(any of several) social studies in ninth grade, U.S. history in eleventh grade, and government in the twelfth grade.*

The social studies department includes sixteen members, although two of the members have major teaching responsibilities elsewhere. The texts that are used in the classes include these:

The California Story (9th Grade)
Wood. Fearon, 1970

Episodes in American History (9th Grade)
Burns, et al. Ginn, 1973

Story of Nations (9th Grade)
Rogers. Holt, Rinehart, 1962

Succeeding in the World of Work (9th Grade)
Kimbrell. McKnight, 1972

The Contemporary World (9th Grade)
McNeill. Scott, Foresman, 1975

This is America's Story (11th Grade)
Wilder, et al. Houghton-Mifflin, 1970

History of the Free World (11th Grade)
Bragdon. Houghton-Mifflin, 1973

The Growth of American Democracy (11th Grade)
Link. Ginn, 1968

Civics in Action (12th Grade)

Gross. Field, 1971

American Government (12th Grade)
Ludlum. Houghton-Mifflin, 1970

McGruder's - American Government (12th Grade)
McClenaghan. Allyn Bacon, 1976

The way in which these materials are used in class follows the more traditional method of instruction described earlier in the mathematics section: lecture-discussion, reading, questions-problems, quizzing. In some classes, the discussion periods at times get emotional and have a tendency to stray away from the topic at hand (personal observation). In other classes, serious attempts have been made to get the students to make better use of the library facilities. One ethnic minority faculty member commented:

> *In my classes I have to lecture. Most of my students don't know how to read or they are reading well below grade level. Consequently, I have to resort to lecturing (they can listen) and using worksheets. The attitude of my kids is good even though they can't do all the work assigned to them. I work with level one and two kids mainly.*

Of the fourteen full-time members of the department, only one is familiar with N.S.F. and its Summer Institute program. Similarly, only two of the members had any familiarity with the N.S.F.-developed packaged curricula. As a consequence, the department does not have any of the packaged programs that are now available to the social sciences from various companies. Most of the materials used in class are either teacher-developed or acquired from the district office.

The problems that seem to beset the science and math Departments at City High seem to be the same ones that are of concern to the social studies department. Student apathy, discipline, student motivation, and poor reading ability are the concerns that were voiced most often by the members of this department. Inadequate supplies, dated reference materials, lack of materials for the non-readers were also mentioned as problem-concern

Western City High School - a class in world history

areas, but not as often as the ones mentioned earlier. The lack of communication with the central office was also voiced as a problem that needed to be corrected. A few teachers also voiced their concern for the lack of parent involvement in the total school program (the high school has no P.T.A. or "Open House" during the year).

Thus, while the members of the department have their concerns about the students and the administration, they themselves are having difficulty in adjusting to the newer approaches to instruction and are having difficulty locating materials that are known to be available.

The teaching staff in the department are well qualified to teach in their areas of assignment. They all hold valid teaching credentials from the state. Their efforts are supported by six teacher aides who act as tutors during the regular class period. This service provided by the district, using special program funds (state), is invaluable according to some teachers because "it provides some individualized instruction for some students that really need help." The teaching staff, similarly, always appear to be on the lookout for materials that will make their classes interesting and motivating. This is evidenced by the fact that, even with a small operating budget, the department, through its chairperson, continues to satisfy the requests made by the various staff members.

> . . . *I try to make my class interesting to the students. I try to get them involved with things that they are reading about. For example, today they are working on graphs. Some students do very well in graphing exercises. Notice that these students seem to understand what goes into this graph: the lines are straight, the labels are there. . . students need this kind of information in order to understand their society better.*

Western City High School - an orientation to government

CONCLUDING STATEMENT

This report concludes the study on the status of mathematics, science, and the social sciences in Western City. The approach taken in this study was primarily observational coupled with data collected from documents made available from various sources. Numerous interviews were held with many parents, students, and administrators. What has emerged from the conversations, interviews, and readings is what is found in this report.

The most significant findings of this study, I would conclude, are the following:

1. The science program for ethnic minority children in Western City is not meaningful enough or relevant to their needs (since most of them do not go to college and a large number of them are not successful in the general science classes) and is producing a science illiterate segment of the population.

2. There has been a decline in teacher commitment to working with students and instructing them in mathematics, science, and the social sciences. Teaching is becoming more "traditional" in approach as evidenced by lack of acceptance of the newer curricula in these areas and the extended use of the text, dittos, and drill-type exercises.

3. Teachers are becoming more dissatisfied with teaching. The benefits derived from teaching are not commensurate with the position; personal satisfaction is becoming less and less a criterion for wanting to remain a teacher and is evidenced by the number of teachers leaving the field and others voicing disgust with the school system.

4. As teachers and students become more militant in their organizing activities, the administration appears to be losing control of the schools. A condition of restlessness seems to be developing with respect to administrative control of the schools. This situation is readily observed by shortened length of time teachers spend in classes, an increase in the number of student absences, and the number of student referrals to the counselors at the school.

AFTERWORD

As explained in Booklet 0, the section on methodology, observers for this CSSE Project were selected to represent different viewpoints, and local respondents and representatives were given opportunities to present disclaimers. For example, in Chapter 12 a site visitor comments in very favorable terms about science education in Western City High School.

In the attachment, one of Western City's district-level administrators presents his version of certain issues described by the observer. Perceptions and judgments, of course, are the keys to understanding this disagreement. The methodology section of Booklet 0 reflects our attempts to anticipate and acknowledge discrepancies such as those spotlighted in this exchange of views.

WESTERN CITY SCHOOL DISTRICT

October 10, 1977

Dr. Robert Stake
University of Illinois
C.I.R.C.E.
College of Education
270 Education Bldg.
Urbana, Illinois 61801

Dear Dr. Stake:

Thank you for the opportunity to add to the report of your local representative, Dr. Serrano.

I met with him after reading his initial report, and provided him some notes to clear up certain areas in his report. Most of these he did not include, so I will cover these here.

As you're undoubtedly aware, the trend all across our country is to encourage individual schools to "do their own thing." This can be seen in all of the ESEA guidelines. With direction like that, it makes it all the more difficult to maintain certain continuity in larger school districts. Individual teachers will comment on things frequently without full knowledge on the area in which they are speaking and leave impressions that may not be representative.

It was never explained satisfactorily to me exactly what the ethnic makeup of schools says about what is being taught in our country in Science, Math and Social Studies. Is the study based on what is being taught in schools of certain ethnic composition? I saw nothing in original outlines to indicate that this was the case. For whatever reasons, the study ended up utilizing largely K-6 schools receiving "Special Funds" (such as ESEA Title I) which could tend to skew the results to some degree.

Continued reference is made to ethnic makeup in negative terms and tenuously tied to instruction and materials. No real evaluation . . . nor was this listed as an area for study.

University of Illinois
Page 2
October 10, 1977

The state laws of California mandate that each elementary school district shall adopt a district-wide Course of Study, and that teachers are required to follow that Course of Study. Our Course of Study is updated each time we have a new state textbook adoption, and our Course of Study covers all of the areas your team was reviewing.

Our district still maintains a somewhat centralized curriculum approach and works with teachers to develop Curriculum Guides for each grade level and subject area. Both a Course of Study and a Curriculum Guide are placed in each teacher's hands. The Curriculum Guide refers to the Course of Study on what to teach, then it provides suggestions on ways of teaching, and lists materials which can be used. These include books, maps, charts, films, filmstrips, cassette tapes, etc. All of these are either at the school site or are available within two days delivered to the school. Almost all materials have been selected by teacher committees, and salary units are afforded those who choose to work on the committees.

Regular meetings are called by the Junior High Consultants to meet with the Junior High Department Leaders. These people are paid an additional stipend to provide leadership in their respective subject areas and are responsible for assisting with curriculum in each of their schools.

In Science, for grades 7-8, our Curriculum is not written to include delving into many of the laboratory type approaches, particularly chemistry and biology. We try to lay a basic science foundation and leave the laboratory skills to the High Schools.

On page 7-5, you refer to 'time limits'. These are non existent, except for a physical education requirement of 100 minutes per week. The state does mandate approximately 20 areas of instruction which must be taught each year, but there are no suggested amounts of time. Also, there are no required time allocations to receive any special funding. However, teachers do feel the pressures of all of the outside influences, including test scores in reading and math and consequently, many of them unintentionally direct a lot of attention to areas tested and excuse this with the statement about 'time'.

Many of the statements, such as on page 7-5, show the constraints felt by many of us, and for which we find no help in resolving.

On page 7-6, you refer to participation in the NSF Science Program. At the time we started these programs, we sent teachers from each school and the principal to a two week inservice. Schools chose the particular science program they desired and this was purchased for the school; SAPA for most . . . USMES for a few. Six Junior Highs were supplied with Silver Burdette laboratories. All schools are supplied with Science materials. These titles were selected by the District Teacher Committee. Then the individual schools selected the one which they desired.

It undoubtedly is true, in terms of priorities, that there is sometimes a tendency to pay more attention to some areas of the curriculum than others. When trying to implement all that is to be taught in a 230 minute day (1st grade), to 300 minute day (6th grade), and a little longer in grades 7-8, there are these constraints.

On several pages testing is mentioned, but it is important to note:

- district requirement is for testing once each year...in the spring
- schools with some sort of "Special Funding" also require a test each fall for "pre-testing"
- I know of no other requirement

For page 7-7, refer also to my notes above.

On page 7-8, it is stated, the Course of Study "is not sent to the district at large." The opposite is true. And regarding what is taught, our total district parent population was assessed as to their priorities on what is to be taught and the results of that needs assessment is used.

On page 7-14, the word "tracked" is used. By definition, tracking is where children proceed through most of the day together, and the negative connotation occurs when this all day placement is determined on the basis of ability. Grouping, and regrouping, based on skill level to be taught is not "tracking."

The "offering" of Science, or any other area, is not at the discretion of the principal. Again, we must refer to the Course of Study. On materials, the 7th grade guide has a 10-page listing of materials, and each Junior High has up to 8 World Maps.

Some of the comments I supplied for the report were used. I don't know why other comments I supplied were not adequate for the report, but I must state, we do have a good instructional program and are proud of it. We also recognize we have room for improvement. But this report supplies few of the positives and delves on social factors. Many of these seem unrelated to the task assigned in this study.

I hope some of these comments add to the total picture of the Western City School District.

Sincerely,

(signed)

Director of Instruction

Rodolfo G. Serrano is Associate Professor of Education in the School of Education, California State College, Bakersfield. His contribution to the CSSE project reflects his special interests as an anthropologist.

Rudy received his Ph.D. from the University of Arizona (1972), after spending twelve years as a physics teacher and several more years as Assistant Professor of Education at, successively, the University of New Mexico and California State College. He has been involved in numerous research activities, and has directed such studies as "A Study of a Junior High School in a Predominantly Chicano Neighborhood" and "Desegregation in the Southern San Joaquin Valley" (both NIE grants); and "Bilingual/Bicultural Fellowship Program" and "Developing Skills for Emerging Educational Responsibilities" (both HEW grants). He is a fellow of the American Association for Advancement of Science and of the American Anthropological Association, and is a charter member of the American Anthropological Association Society for Visual Anthropology.

His publications include two books, Los Bareleenos de Albuquerque, Nuevo Mexico and Dictionary of Pachuco Terms, *and several films. One of these, "El Gato y El Raton" ("Migrant Children at Play"), was accepted by the Smithsonian Institution for its archives. Rudy has also presented papers at a variety of educational conferences and has served as a consultant to local, state, and federal groups involved in education.*

He lives in Bakersfield with his wife, Greta, and their three children.

Chapter 8

"SCHOOL WITHOUT SCHOOLS":
COLUMBUS OHIO'S EDUCATIONAL RESPONSE TO THE ENERGY CRISIS OF 1977

James R. Sanders and Daniel L. Stufflebeam
Evaluation Center
Western Michigan University

January-February 1977

8

School without schools: enough in name alone to quicken the professorial heartbeat of anyone interested in the pedagogical enterprise! The Columbus story tells us how teachers were expected to and did perform in a setting for which they had received not the slightest bit of training. It should not surprise us that the teaching did not prove to be a festival of creative response to the political necessity for teaching in places other than the classroom. The teachers simply did not know the territory.

While it should be obvious to all that knowledge of subject matter has little relationship to the effectiveness of the teacher, one suspects that teacher training might aid its clients through an increase in attention paid to techniques for instructing learners in places other than the classroom.

The pattern of elementary teachers working outside of schools as they did in school is clear in the Columbus report.

> *Subject areas being emphasized by classroom teachers at the elementary level during School Without Schools were reading, spelling, and mathematics. Teachers reported that they had been requested by central administrators to concentrate on these basic skill areas. Some history and social studies topics were being taught, but there was very little attention given to science.*

> *The science curriculum, especially at the elementary level, was revealed to be weak in both the School Without Schools Program and the regular school program. Science is a little-taught subject by many teachers at the elementary level.*
>
> *Those at the elementary level who did teach science mainly followed a textbook.*

A similar profile was charted for the secondary teachers in both science and non-science subjects.

> *Teachers reported that there was considerable pressure to cover material that would normally be taught during this period. Most felt that they were one to two weeks behind after regular school resumed. Teachers also were relieved that structure and rules returned to normal after School Without Schools.*

The reader with a socio-anthropological bent will find the discussions of turf intriguing: "I don't want anyone coming from another school to start using MY laboratory and MY chemicals (or equipment)."

Of course the nonconformists were noted. "One biology teacher offered his students a two-week trip to Florida under his supervision; and having received about ten volunteers, packed several vans and took the group to Florida along with a couple of parent chaperones."

One of the summary items offered by Sanders and Stufflebeam wraps it all up:

> *We saw that School With Schools was the most effective component of the School Without Schools Program.*

A decade ago Seymour Sarason studied the manner in which schools change and how we try to change them. His tenet is upheld by Sanders' and Stufflebeam's study: "The more things change in education the more they remain the same."

"SCHOOL WITHOUT SCHOOLS": COLUMBUS, OHIO'S EDUCATIONAL RESPONSE TO THE ENERGY CRISIS OF 1977

James R. Sanders and Daniel L. Stufflebeam

In 1977, Ohio, like much of the rest of the nation, experienced its coldest winter in more than a century. This fact, coupled with an acute shortage of natural gas to meet the heating needs of Ohio's industries, businesses and homes, presented a special emergency situation for all the school districts in the western half of the state. Heat levels had to be turned down in order to preserve pressure in the gas delivery system; and buildings, plants and animals in the school buildings, as well as expensive equipment, somehow had to be protected and preserved. More importantly, it was necessary in many cities in Ohio to close schools to the use of children and educators.

Rather than accept a mandated holiday for a month, the Catholic and public schools in Columbus, Ohio, decided to meet this challenge with an innovative response. They called it the School Without Schools Program. In effect, they decided to continue to pay educators to deliver education and to use the total community as the classroom for the delivery of instructional services. The community supported the Columbus schools in this program. Television and radio stations devoted more than twenty hours per day to the delivery of educational programs. Businesses and educational institutions in the area opened up their facilities to use by students and teachers. The community mounted a massive busing program to transport students to zoos, museums, libraries, industries, a police academy, and many other stimulating settings. Teachers convened their classes in homes, bank lobbies, and churches. In short, Columbus mounted, almost overnight, a total community education effort.

In the early stages of this program, the National Science Foundation decided to support a study that would describe and analyze the School Without Schools Program and assess its effects. NSF wanted to know particularly how math and science teachers responded to this type of emergency. They wanted to know what decisions had to be made in mobilizing this school district to do this program, and they wondered whether there is any merit in developing contingency plans based on the Columbus experience so that other schools might be prepared to meet a similar crisis. To address these questions, a team, based at Western Michigan University's Evaluation Center, was commissioned to conduct a study of the Columbus School Without Schools Program.

That study involved intensive efforts to gather appropriate information by various means. Experts visited Columbus both during and following the School Without Schools Program to observe it in action, to gather existing documentation, and to interview various people who were involved in, or affected by, the program. Randomly sampled groups of teachers, students, and parents were surveyed to obtain information about their experience and their perceptions of the program. Surveys were also conducted through the local newspapers; and Nielsen and Arbitron television ratings were collected and analyzed, since those ratings were taken during and following the time of the School Without Schools Program. Case materials including a television documentary, diaries and scrapbooks, and studies done by other researchers of the School Without Schools Program were collected. Hearings were conducted with teachers who taught over television; science, math and social studies teachers; and the Columbus PTA Council. People at all levels of the program, including individual parents, teachers, and students in the public schools were interviewed. Public and Catholic school administrators in area educational institutions, as well as personnel of the public media stations and newspapers, were also interviewed. A massive amount of information bearing on the School Without Schools Program was thus amassed.

This report presents a segment of the findings, particularly those that deal with issues of math, social studies, and science teaching. Additional findings are presented in the general study report.[1]

This report contains the authors' interpretations based on their review of a large amount of data. Citations to specific testimony and findings are presented to illustrate the main interpretations that we believe are warranted. While we attempted to choose anecdotes that would help the reader get a valid view of the background data, we realize that we could have chosen other anecdotes that would have formed a different perspective of the data. Also, the data we gathered certainly were far from the complete set that were available for collection. Overall, we gathered much data which we have attempted to distill and present here with helpful examples; we realize that our report is not complete and may be inaccurate in some unknown ways; but this report contains our best interpretations of the complex program called School Without Schools.

Observations contained in this report are presented in four sections. The first contains information about the setting and the program that was studied. The second provides a description of characteristics that were general to science, math, and social studies instruction at all levels of the Columbus Public Schools and the Catholic diocese during the School Without Schools Program. The third contains findings particularly relevant to elementary instruction, especially in science, and the fourth deals with instruction at the secondary level with an emphasis on science education.

An attempt has been made in this report to be descriptive rather than judgmental. However, it was not always possible to make this distinction because much of the data collected were people's perceptions concerning how well the program had operated.

THE SETTING AND THE PROGRAM

The Setting

Columbus, Ohio, is a capital city. According to the Columbus Area Chamber of Commerce, the population of the standard metropolitan area (1970 census) is 1,017,847. The city of Columbus itself has a population of 539,677, of which 19% is nonwhite.

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[1] Sanders, J. R., and Stufflebeam, D. L. A Study of School Without Schools: The Columbus Ohio Public Schools During the Natural Gas Shortage, Winter 1977. Kalamazoo, Michigan: Evaluation Center, Western Michigan University, 1977.

The city is served by the major state university and seven other colleges and universities within the surrounding area. In addition, there are four business and technical schools of higher education in the county. Columbus is a center of cultural activity in central Ohio with five major theaters, nine community theaters, two ballet companies, professional sports, and public recreation. Fourteen musical organizations, four fine arts galleries, and a number of cultural arts centers are also found in the city. It is the second-largest city in Ohio and twenty-first largest in the United States. It is also the only major city in Ohio showing an increase in population from 1970 until 1974.

The principal employers in Columbus are the State of Ohio, the Ohio State University, the federal government, the Columbus Public Schools, two large department store chains, the City of Columbus, Western Electric Company, and Ohio Bell Telephone. The impression one gets from a visit to Columbus is that it is a growing, vibrant, midwestern city with substantial resources that contribute to the cultural and educational well being of this community. Its population is a cross-section of American society.

The Columbus Public Schools serve approximately 96,000 students in 177 school buildings, which is a drop of about 14,000 students over the last ten years. The Catholic Diocese in Columbus serves another 15,000 students. The Columbus Public Schools' budget for the school year runs about $116,000,000, of which 87.1% goes to salaries and fringe benefits.

The Columbus Public Schools have had a history of close community relations evidenced by participation of school district administrators in community service organizations such as Kiwanis. Other evidence of this close relationship includes frequent meetings between school administrators and city and state government officials, periodic and frequent media presentations by school personnel over television and radio, and the existence of central administration staff assigned specifically to communicate district information to parents, legislators, government and business leaders, the media, and representatives of community special interest groups. The school board has had a good relationship with the superintendent and his central administration staff, supporting them at almost every turn.

However, the Columbus Public Schools did face several difficult problems in 1976-77. In November, 1976, a levy failed and the levy was to have been brought up again in June, 1977. Furthermore, the school district was involved in a desegregation suit brought about by the Columbus chapter of NAACP. The racial makeup of the schools is approximately 67% white and 33% nonwhite; and although no noticeable civil disturbances existed, the black community was concerned that the distribution of students to buildings within the district had historically segregated black students. The makeup of the school board is four whites and three blacks. Several votes, especially those relevant to the desegregation issue, followed racial lines.

Factors that led up to the School Without Schools Program included weather, politics, and economics. No one had anticipated that Columbus would experience the coldest winter in more than one hundred years in 1977, and this certainly has to be pegged as the main reason for the closing of all but thirty-six of Columbus' school buildings. Backup emergency gas supplies had been made available to users by Columbia Gas during August, 1976, but the price would have been higher for this supplementary gas and its offer carried the stipulation that the more expensive gas had to be used first. Because no one could have predicted the cold winter, the school administration made a fiscally prudent decision in August not to order the supplementary supplies. By the time the crisis hit in February, 1977, Columbia Gas had released the supplementary supply and it was too late to retrieve it. There were some strong feelings that a dispute between Columbia Gas and the Ohio legislature over the former's authority to assess Ohio residents for the acquisition and storage of contingency gas supplies was another cause for unpreparedness. Many charges and counter charges were heard during the school shutdown. One such charge was that Columbia Gas has released its back-up supply of natural gas in order to make the residents of Ohio realize their dependence on

Columbia Gas for continued and adequate gas supp[illegible]s during cold winters. Since the weather turned out to be much more severe than anticipat[illegible] the gas shortage was far greater than Columbia Gas officials or anyone else might have [illegible]ed. Whether or not such charges are true, it was true that Columbia Gas and Columbia [illegible]mission services were inadequate to meet the needs of Columbus and indeed of service a[illegible] through western Ohio.

The most noteworthy context factors preceding the School Without Schools Program were as follows:

a. The good relationship of the Columbus Public Schools with all segments of the community--parents, city and state government leaders, science organizations, business people, media leaders;

b. The good relationship of the Columbus Public Schools' central administration with the school board and teachers' union;

c. The strong second and third level administrative staff of the Columbus Public Schools;

d. The accessibility of the state legislature;

e. The cooperation of public and parochial school administrations in Columbus;

f. The extensive community resources available for educating children outside public school buildings;

g. Prior planning for a crisis contingency program in the event schools would be shut down; and

h. The nature of the crisis--a natural disturbance (vs. a civil disturbance).

Detailed context information is provided in the general study report.

The Program

The object of the observations contained in this report was the School Without Schools Program initiated by the Columbus Public Schools in response to a mandated shutdown of facilities by the Columbia Gas Company during February, 1977. The purpose of the shutdown was to conserve quickly disappearing supplies of natural gas so that homes, necessary facilities such as hospitals, and businesses could remain open. The School Without Schools Program began its operation on February 7, 1977, and concluded on February 25, 1977. The week following the School Without Schools Program was designated as a Spring vacation. This vacation time had been originally scheduled for April, but was moved up due to the natural gas shortages.

The design of the program was extensive and detailed. Furthermore, it was compiled and distributed to school personnel on short notice (within a week's time). Important elements of the design may be categorized as follows:

a. Communication

   -to school personnel
   -to students and parents
   -to the community

   Communication efforts included: (1) The School Without Schools Handbook made available to all school personnel and supplemented with written daily bulletins; (2) a telephone hotline; (3) a war room (of telephones) for school building personnel to arrange field trips and have questions answered; and (4) daily bulletins in the newspapers and over radio and television.

b. Program

Instruction occurred via field trips, meeting one day per week in a school building, meeting outside the school with instructors, television, radio, newspapers, and working at home on assignments.

c. Facilities

Facility maintenance was achieved via detailed mothballing procedures by district custodial staff for those buildings that were closed and via regular maintenance procedures for those buildings left open. Safety and security were prime concerns when buildings were closed. Support personnel, such as the evaluation unit in the Columbus Public Schools, were used to aid in the maintenance of facilities.

d. Transportation

Busing students for field trips and scheduling new bus routes for the one day per week in-school sessions were the main concerns in transportation. Safety of children attending school functions received considerable attention. The City of Columbus, under Mayor Tom Moody's leadership, granted $25,000 to the Columbus Public Schools to support the increased transportation expenses that were due to the School Without Schools program.

GENERAL OBSERVATIONS PERTAINING TO EDUCATION DURING SCHOOL WITHOUT SCHOOLS

The importance of contingency planning for and during crisis situations was demonstrated in the School Without Schools Program. Both the Catholic Diocese and the Columbus Public Schools, as well as the State Department of Education, had rudimentary contingency plans of various forms available. The Catholic Diocese had planned for the eventuality of being closed out of their gas-fired buildings, and had projected that they would cycle their students through the other buildings that were heated by coal and electricity. This contingency plan became a general strategy of both the Columbus Public Schools and the Catholic Diocese throughout the energy crisis. Also, the Columbus Public Schools had developed a contingency plan months prior to the energy crisis, in case of a teacher strike; and each building principal had a building plan on hand in case of emergency. Furthermore, because of the Xenia tornado of several years ago, the Ohio Department of Education had developed contingency plans for school districts in the event of environmental or social emergencies; and this agency produced a detailed plan for closing down school buildings as a specific response to the 1977 natural gas crisis.

Several findings denoted the importance of contingency planning in this Columbus emergency. Both central office and building administrators pointed to the usefulness of advance planning that had been done, as well as to the day-to-day evaluation and planning during the crisis. These administrators praised the Ohio Department of Education for their detailed plan for mothballing a school building and complained only that the plan was not made available sufficiently early during the crisis. Also, some of these administrators were critical of Columbia Gas for not having done sufficient contingency planning. Moreover, many teachers thought that the main problems in the program were due to a lack of decisive and clear guidance at the outset of the program. There was widespread agreement that better planning earlier and clearer communication of the plans at the outset of the program could have eased many teacher, principal, and student problems and probably would have led to more consistent and extensive use of the School Without Schools Program.

There were several persons, events, and decisions that shaped the education system during School Without Schools. First, there were strong leaders in both the public and Catholic schools in Columbus. The two school superintendents were able to stimulate and manage a massive and cooperative effort between the public and Catholic schools. To support them there were strong second and third level administrators. Further, curriculum specialists developed media presentations and evaluators provided administrative support.

Second, the Columbus Public Schools immediately involved the Columbus Education Association (CEA) in all planning and decision making for the emergency program. The superintendent reported that before he took any actions, he met with the CEA director and asked him for his thoughts about the idea. The superintendent did not move until the CEA director said, "Let's go with it." Moreover, decisions about moving the Spring break from April to February and about the nature of teacher (and hence, student) involvement (eventually defined as voluntary except for the one day per week in school) had to be negotiated between the superintendent and the CEA. Teachers were expected to teach in a host school the one day per week, and were asked to be creative in pursuing learning activities, perhaps along nontraditional lines, the remainder of the time. It was agreed that no checks would be made on how teachers spent their time during School Without Schools.

Probably because of the permissiveness (voluntary nature) of the program, there was great variability in the extent to which students and teachers participated in the out-of-school portion of School Without Schools. Also, this decision may have accounted for some decrease in attendance at School Without Schools activities that proceeded from the first through the second through the third weeks of the program. Apparently, a "novelty effect" was operating during the first week and probably stimulated and sustained involvement of a great many students at first. However, this seemed to begin wearing off during the second and third weeks as more and more students stayed away from the out-of-school activities. Moreover, no particular category of students stayed away any more than any other. Several teachers at both the elementary and secondary levels commented that they were not sure how much longer than three weeks the program could be sustained.

Third, early offers of emergency help from a local commercial television and radio station, the newspapers, Ohio State University, and a few other community agencies actually started the ball rolling for the community involvement aspect of the program. Without these offers stimulating a wealth of other offers, community reaction may have been too slow to help.

Concerning the program itself, there were a number of general conclusions made by observers. First, and probably most obvious to all, teaching and learning seemed to suffer by comparison to regular programs under the School Without Schools conditions. Even though there was no intent to make School Without Schools a replacement for the regular program, a comparison did reveal deficiencies in School Without Schools that could have been overlooked. School Without Schools was seen to pose a threat to the educational well-being of the college-bound eleventh and twelfth graders who needed to maintain content coverage in preparation for college and who needed as much preparation as they could get for the coming college entrance examinations. These students also worried that a hiatus in instruction experienced in the School Without Schools Program would have a negative effect on GPA. City-wide testing results and SAT scores compiled at the end of the school year indicated that student test performance was not hurt by School Without Schools. Average performances at the grade levels that were tested showed slight gains in 1977. It appeared that there was a slowdown in instructional pace during School Without Schools, but that lost ground was made up by the end of the school year In general, it seemed that School Without Schools was seen by teachers and outside observers to work best at the elementary level, next best at the junior high level, and least well at the high school level. Overall, almost everyone agreed that there was nothing sufficiently compelling and desirable about School Without Schools that would warrant its repetition as a regular program. However, it was accepted as a successful emergency program.

Second, it should be noted that there were many features of School Without Schools that were constructive and viewed by most as desirable. Social integration was aided because of the integrated learning that occurred when schools came together in the few buildings that were open to the students and because of the integrated tours and other activities throughout the program. Also, School Without Schools revealed it could work well for self-directed and parental-directed learners. Considering what was seen to work best in School Without Schools, participants noted that the School With Schools portion of the program (one day per week) was the most used and most effective of all the program elements. Next in effectiveness and frequency of use were the many homework assignments that were given. The third most used and effective element seemed to be the tours, especially at the elementary level. It must be added that the tours added a little flavor of science education not found in the regular program. While the TV was the most visible part of the program and the one that received the most national acclaim, it was also one of the weakest instructional parts of the School Without Schools Program. This was not because the programming and presentations were poor, but because there was little motivation to use them or opportunity to relate them to the programming and teaching being done by individual teachers. There was little advance involvement of regular teachers in curricular decisions; and advance information about what would be on the media--which was needed by the teachers in order to plan for and use this service--was missing.

Third, the crisis evoked public services from people and agencies throughout the community. Early on there was a cooperative response and this response had a positive effect on how the community viewed itself and its schools. The Columbus Public Schools recorded the number of different non-school facilities used for instructional purposes during School Without Schools. All were used heavily. The record of use was as follows:

Private homes	693
Recreation Centers	29
Churches	59
Banks	12
Restaurants	28
Fraternal	3
Private Recreational	16
Hospitals	9
Hotel/Motel	4
University/Schools	7
Businesses/Stores	33
Apartment Party Houses	16
Day Care/Community Centers	39
Federal Government	1
Library Branches	19
	968

Fourth, School Without Schools enhanced the public relations of the schools in Columbus. Teaching and learning were made more visible, especially on TV and radio; School Without Schools resulted in increased and improved parental involvement in education. There was clearly some creative, stimulating teaching that impressed people throughout the community. At the same time, however, the program did reveal some poor, unmotivated teaching.

Finally, the School Without Schools experience prepared school personnel in Columbus for handling emergency closings if they should occur in the future. In the area of science education alone, and just considering decisions that had to be made regarding books and equipment, the closing of buildings proved to be extremely complex. At the elementary level, all liquid chemicals had to be flushed down a sink, aquaria and aquaria filters and pumps had to be drained, living creatures needed homes, and plants and terraria required protection from the cold. Teachers had to keep records of textbooks taken home and had to monitor use of consumable workbooks. At the secondary level, in addition to the actions listed above, teachers had to find homes, and keep records, for calculators and other sensitive equipment. Every aspect of the school system required attention and responsible action by school personnel.

The most important general educational implication of the School Without Schools Program related to planning. It made apparent the importance of contingency plans at all levels of the system. It also raised again the possibility of instituting winter vacations with the addition of school days during the summer months. However, while it raised the question of winter vacations, observations also confirmed that socially such a change would be resisted by teachers and parents. Overall, School Without Schools was an interesting example of a community's collective and innovative response to a common major emergency.

ELEMENTARY SCIENCE EDUCATION DURING SCHOOL WITHOUT SCHOOLS

Although not unique to science education, there were observations unique to education at the elementary level. Holding elementary sessions in secondary buildings created some problems. Facilities, such as blackboards and desks, were outsized for elementary students. The presence of high school and elementary students together created some problems for the elementary students when high school students forgot to be considerate of the little persons. There was no adequate playground for recess outside and there were no large toys for kindergarten students inside. Also, elementary teachers found it was difficult to maintain discipline with elementary students in big secondary buildings. However, in one high school cafeteria, teachers were surprised to find that it was easier to socialize elementary kids in the movable chairs and tables than in their normal classroom. Children's interest was high only in the classrooms where games were played. In classrooms where students were meeting with their teacher only once a week, interest was low and the children were restless. In many classrooms it was observed that the teacher's role was more that of a facilitator than teacher as he or she had children complete assignments or gave individual help as needed.

In many respects, School Without Schools was seen to be more appropriate for the elementary level than for either the junior high or the high school levels. One reason for this is because elementary students have a single teacher, with that teacher feeling direct and complete responsibility for a single group of children. At other levels, responsibility is diffused across several teachers for a given group of students and across several groups of students for a given teacher. Single teacher responsibility was seen as potentially much stronger than the diffused responsibility found at the secondary level as a means to promote the learning of students who are not in a highly structured environment. Overall, it must be said that School Without Schools was observed to maintain instruction better at the elementary level than at the secondary level.

Methods used in elementary level classrooms during School Without Schools included question/answer discussions, teacher demonstrations, workbook assignments, and individual help. Out-of-class methods included meeting in small groups, attending to TV and radio instruction, using the newspaper school supplement (Classroom Extra), contacting teachers by telephone, and going on field trips. Elementary teachers found their small group contacts to be quite productive. Teachers working with small groups of children in places outside the school discovered they were becoming better acquainted with their children and were teaching more material than would have been possible in the regular classroom. This was so because of the small groups of students teachers had formed. This was much different from the large group instruction most engaged in during the regular program. Some said their small group contacts were more successful than their one day in school contact. One first grade teacher found that two children who she thought were possible retentions had made so much progress during School Without Schools as a result of small group work and parental help that they would probably not be retained this year.

Transporting one's own materials or borrowing those in a host school were a particular problem that the elementary teachers faced during School Without Schools. One teacher said she had to haul three boxes of materials into the school just to teach reading, spelling, and math. Organizing for the one day in school and organizing all the material for the out-of-school assignments was found by many elementary school teachers to be a formidable task.

Subject areas being emphasized by classroom teachers at the elementary level during School Without Schools were reading, spelling, and mathematics. Teachers reported that they had been requested by central administrators to concentrate on these basic skill areas. Some history and social studies topics were being taught, but there was very little attention given to science.

The science curriculum, especially at the elementary level, was revealed to be weak in both the School Without Schools Program and the regular school program. Science is a little-taught subject by many teachers at the elementary level.

Those at the elementary level who did teach science mainly followed a textbook. A second grade teacher said she had attended grade level science workshops for Columbus teachers and had been given all the science supplies she needed. She said all teachers had the opportunity to attend these workshops. The obvious inference was that teachers could get assistance to teach science; but that for whatever reasons, they resisted and did not use such assistance. Reasons given for not teaching science in the regular or School Without Schools Programs at the elementary level were: dislike of the textbook, dislike of a textbook approach, lack of equipment, lack of knowledge to teach science, lack of time, the need to share textbooks, and the fact that science was graded every other six weeks. The generality of these reasons cannot be judged, but it is suggested that they could be pursued as hypotheses concerning why there seems to be so little science being taught in the elementary grades of the Columbus Public Schools. Other than science-related field trips, few teachers planned science lessons for their classes. One teacher took her class to her home to learn how to care for and feed horses. Another teacher related that she had had the children play a science game patterned after a Columbus television program called "In the Know," in which students from two schools compete by demonstrating their knowledge of various topics. This teacher's questions for her "In the Know" game were based on an "out of school" science assignment.

The use of field trips was highly variable both in terms of teachers' employment of them and in terms of the purposes for which they were used. Reasons given by teachers for taking field trips were: to supplement a social studies or science lesson that had been taught before school closed, to extend science concepts, to enrich children's experiences, and to serve as motivation for discussion when school resumed. For example, one sixth grade teacher with a predominantly black class did not meet with her children for instruction outside school; but she did take small groups of students to the Center of Science and Industry, the Ohio State School for the Blind, the Black Cultural Center, the Lincoln LeVeque Tower, and the TGI Friday, a mod restaurant in Columbus, for enrichment experiences. Some of the field trips (to the Center of Science and Industry, Ohio wild flowers and trees display and the bird refuge at Blendon Woods Pond, environmental and planetarium laboratories, etc.) created a science flavor in the elementary portion of the School Without Schools. This suggested that expanded use of field trips would be one way to build the science curriculum in a district that has been apparently resistant to science at the elementary level. Only one elementary teacher gave a reason for not meeting outside school with her students. She said they were not motivated to learn and would not attend.

Elementary teachers were divided about the success of School Without Schools. Some said it caused students to drop hopelessly behind. Others said students would get as much attention as they did during the regular program, and maybe more. Most seemed to indicate that School Without Schools was making the best of a bad situation. Some elementary teachers saw many successful aspects of School Without Schools. Frequently mentioned aspects were parental help and cooperation, community support, small group and individualized instruction, opportunities to tutor slow learners, and stimulation provided the students for their own self-directed learning. At best, School Without Schools was judged by teachers to be a remedial program for slow learners. Generally it was seen to be a holding pattern at the elementary level. After several observations, it was concluded by the team of experts that elementary teaching was not innovative during or following School Without Schools. Teachers were observed to use conventional methods of teaching and stressed the basics.

SECONDARY SCIENCE EDUCATION DURING SCHOOL WITHOUT SCHOOLS

The general observations made on pages five through eight of this report about the condition of education during School Without Schools applied equally to elementary and secondary science education. These general points will not be repeated. There are some additional points, however, that appeared to be unique to secondary education; and further, there were observations that could be separated among the categories of secondary math education, science education, and social studies education.

It was evident during the three-week School Without Schools Program plus one week vacation that more written work/homework was being assigned to students than was assigned in the regular program. This heavy emphasis on homework showed up at the secondary level across all subject areas. A second general observation at the secondary level was that great confusion existed over grading during School Without Schools. Even after the normal program resumed, both teachers and students were unsure whether grades would be assigned for the period as: (1) pass/fail, (2) extra credit, or (3) grading as usual. A third, fairly pervasive, aspect of secondary education was the relief felt by teachers to get back into regular session after School Without Schools ended. Teachers reported that there was considerable pressure to cover material that would normally have been taught during this period. Most felt that they were one to two weeks behind after regular school resumed. Teachers also were relieved that structure and rules returned to normal after School Without Schools.

In secondary mathematics, the typical method of teaching during School Without Schools involved review of homework, brief explanations, and question-answering. Help sessions were provided by most teachers either during the one day a week at school or outside the classroom. The teaching methods were observed to be not very different from the regular program. Exceptions to this general observation included observing one teacher using special activities and projects as a method of teaching, another teacher using frequent testing which was not evident during regular sessions, and a third teacher using learning packages that she had developed. The learning packages were seen as one of the most innovative approaches used by those secondary math teachers who were observed. There were also numerous incidences of teaching enrichment material in secondary math during School Without Schools. Two examples were the teacher taking the opportunity to teach probability and statistics and another teacher teaching number theory. Both topics were ones that would not have been covered under normal conditions.

Few math teachers used the media or field trips during School Without Schools. Only one of the teachers observed at the secondary level in mathematics was attempting to use the television lessons as a component of instruction. A few others had suggested to students that they watch the television programs, but these teachers were not integrating it with their classwork. Teachers frequently commented that content of the television programs was not made known to them until after they had already planned their lessons, and they apparently felt no repsonsibility for using the television lessons. Others noted that the content of the television lessons did not parallel their own instruction, and hence, did not attempt to incorporate television into their classes. Radio and newspapers were used even less often than television by math teachers.

Several teachers felt that students had suffered more in mathematics than in other classes. The comment was made, "School Without Schools was more difficult for science and math than for social studies because one unit builds on another, especially in math." One teacher was giving quizzes to add marks for grading purposes rather than marking on the basis of one test. Another secondary math teacher noted that her evaluation of the students' work done during School Without Schools showed that performance was poorer than usual. This teacher and her student teacher had made a special effort to integrate TV lessons with work sheets and text material into learning packages for the students; and both teachers had been available to the students extra hours beyond the once-a-week class session. Their geometry students did not take the initiative to come in for extra help. They seemed to have watched the first TV lesson, but none after that. These teachers' Algebra II students also were a disappointment. They did not do as well on the tests and homework on rational numbers as was expected. The teachers attributed this to the fact that the students were not mature enough to do so much of the algebra on their own, even with their guidance through the learning packages and the in-class sessions. They felt that the three-week period was especially hard on students in the upper level math courses. These teachers were interesting to observe because of the special efforts they had put into School Without Schools. They demonstrated that it was possible to be creative and productive under crisis conditions. Not all of their efforts went unrewarded. Some of their contemporary math students who had four special projects to do in addition to the learning packages pleasantly surprised them. They said that some of the students who had usually not responded well to the regular work had made good attempts on the projects. They also commented that the nature of the projects (a home floor plan, a personal cash flow record, a family budget for a month, and income taxes) had made them much more aware of the students' home life and of the problems students bring to school than did any previous work they had done.

In secondary science the typical method of instruction was one of "hand in the assigned homework and we'll discuss it." Demonstrations and laboratory exercises were greatly reduced during School Without Schools. Reasons given varied, but the two following were voiced frequently: (1) "Not enough time in one class period when you have to give assignments and collect papers"; (2) "I don't want anyone coming from another school to start using MY laboratory and MY chemicals (or equipment), and I wouldn't go into another school and use another teacher's laboratory and use his chemicals (or equipment)." Communication and cooperation about equipment use needed to be encouraged and facilitated. One teacher felt that the administration should have mandated that each teacher mount a complete educational program. This might have included instruction, laboratory, help sessions, and evaluation plans. There was a recognized need for self-contained instructional units or packages. Such packages might include objectives, references, materials, worksheets, evaluation materials or activities. Observation of secondary science education indicated that many students were really not used to reading in order to learn. They had become dependent upon oral and visual learning.

Science instruction in the secondary schools during School Without Schools could generally be characterized as follows:

a. Worksheets

The students were given handouts either prepared by or selected by the teacher; these handouts included questions and problems related to the topics under study. The students were to complete these worksheets and problems from week to week.

b. Lecture and Discussions

The time in class was spent in discussing questions and difficulties encountered by the students. These difficulties were identified by the students in some cases, and by the teacher in other cases. The response to student questions or teacher-identified needs was mostly in a lecture mode once the difficulty was clarified.

c. Extra Sessions

The teachers generally had some additional contacts arranged with the students. They were basically of three types: field trips, help sessions or telephone contact. Attendance was low at these additional meetings. Teachers seemed to feel that the students who were most in need did not attend.

d. Laboratory

There was little laboratory activity.

There were a few interesting projects in secondary science that were created by individual teachers. One student teacher asked the students in his biology class to keep records of food intake, energy output, and weight change for part of a unit on nutrition. At the end of School Without Schools, students reported their data and discussion followed. Another biology teacher offered his students a two-week trip to Florida under his supervision; and having received about ten volunteers, packed several vans and took the group to Florida along with a couple of parent chaperones. He said the group learned a lot during those two weeks observing different botanical and zoological specimens as they appeared in nature. The appropriateness of this activity might be questioned, since the students who went to Florida were not present in Columbus to pursue their total program of study. Again, it would seem apparent that the elementary organization, that has one teacher per group of children, was more conducive to the full out-of-school activities than was the secondary program, which has several teachers crossed with several groups of students.

In secondary social studies, like secondary science, the typical method used during School Without Schools was "hand in the assigned homework and we'll discuss it." Observed classroom periods involved about 65% of class time in independent work by students and 25% in students asking questions and teachers providing answers. The remaining 10% was spread over many different activities.

Some social studies teachers took advantage of School Without Schools to provide their students with experience and discussions that ordinarily would not have occurred. One secondary sociology teacher took the opportunity to develop a survey of student attitudes toward School Without Schools as a class project. The questionnaire developed by the class was administered to a sample of secondary students. The data were analyzed and written up in a research report. Another teacher called each student every week for a one-half hour conversation about their social studies lesson (morals and facts). A third used in-school time for reading and note-taking activities and discussion of Russian political concepts. The reading done by the class was George Orwell's Animal Farm, assigned for the purpose of reviewing and criticizing concepts associated with communism. The teacher went around the room speaking to individuals when signaled by raised hands. Student attention in this class seemed to be very much directed on doing the assignments.

In retrospect, School Without Schools presented secondary science teachers and their students with an opportunity to diverge, to open up, to get out of the routine. Some took the opportunity and were gratified. Most did not at the secondary level; and, as at the elementary level, once classes resumed, little noticeable residue in science education from School Without Schools remained.

IN SUMMARY, WE SAW

- a high degree of professionalism and dedication on the part of the teachers, but also some poor teaching.
- a great deal of traditional teaching and only a modicum of creative instruction.
- the idea of massive instruction over the public media tested, but it did not work.
- that School With Schools was the most effective component of the School Without Schools Program.
- that math, science, and social studies, in that order, are important parts of Columbus programs; but also that these topics are often not taught very well--especially at the elementary levels.
- that contingency planning both before and during a crisis is an art that educators should master.
- vividly that education is and must be the concern of all segments of society, especially during an emergency.
- that Columbus has good community strength, and that they can muster it in the face of a common enemy.
- a tough-minded and competent performance on the part of the public and private schools, but a weak performance by the gas company.
- that none of us are the masters of our own destinies, and that working together is often essential.
- finally, that School Without Schools could be described as total community involvement in making the best of a bad situation.

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Jim's teaching interests (evaluation methods, research methods, statistics and measurement) and research interests (field experiments, testing, assessment, and research and evaluation methodology) are reflected both in the projects in which he has participated and in his publications. The former include work with the USOE Clearinghouse for Applied Performance Testing; statewide assessment projects for Alaska, Hawaii, Oregon and Washington; the Graduate Program Development Project for the Faculty of Education at the University of British Columbia; and the External Masters Degree Project at the Western Michigan University Evaluation Center. His publications include articles in the Review of Educational Research, Educational Researcher, Journal of Educational Psychology, Educational Technology, and the Journal of Research and Development in Education. He is coauthor (with D. J. Cunningham) of the chapter "Technique and Procedures for Formative Evaluation" in Evaluating Educational Programs and Products, edited by G. Borich and published by Educational Technology Press. He has edited the Proceedings of the Conference on Problems and Potentials of Applied Performance Testing (with T. Sachse, published by Northwest Regional Educational Laboratory) and co-authored the book Educational Evaluation: Theory and Practice (with B. R. Worthen, published by Charles A. Jones).

DANIEL STUFFLEBEAM

Daniel Stufflebeam has been the Director of the Evaluation Center and Professor of Education at Western Michigan University since 1973. Previously, he served for two and a half years as a public school teacher in Iowa and Chicago and for ten years at the Ohio State University, where he advanced from instructor to professor and where he directed the test Development Center and later the Evaluation Center. Recipient of a Ph.D. in measurement and research methodology from Purdue University (1964), he has also participated in a post doctoral program in statistics and experimental design at the University of Wisconsin (1965).

He has chaired several important committees including the NCME Board's Finance Committee, AERA's Research Training Committee, the PDK National Study Committee on Evaluation, and the PDK 11th National Symposium on Educational Research. He is currently the chairman of the Joint Committee on Guidelines and Standards for Educational Evaluation and is a member of the AERA/APA/NCME Committee on the Review of the Standards for Educational and Psychological Tests. He has also served on the editorial boards of the Journal of Higher Education, Educational Technology, Evaluation Comment, and Evaluation and Program Planning: An International Journal.

He has served as lecturer at the University of New Hampshire and the University of Jyvaskyla, Finland, and has been an advisor to numerous governmental and educational agencies.

At Ohio State University he performed research on the item sampling technique and educational change, directed the development of more than 100 standardized tests (including eight forms of the GED tests), developed the CIPP Evaluation Model, and assisted several local, state, and national agencies to install evaluation systems. Since moving to Western Michigan University, he has conducted several major evaluation studies, has codirected an AERA traveling training institute in evaluation, and currently is directing or codirecting projects to develop standards for educational evaluation, to study the Columbus, Ohio, public school system's response to the energy crisis of 1977, and to assist Western Michigan University to install a university-wide program review system.

He coauthored the book Educational Evaluation and Decision Making, and his articles and book reviews have appeared in JEM, Educational and Psychological Measurement, Psychometrica, Kappan, Journal of Research and Development in Education, Theory into Practice, Studies in Evaluation, the Journal of Higher Education, and in several books of readings.

Chapter 9

SCHOOL SCIENCE IN AN EASTERN MIDDLE SEABOARD CITY

Jacquetta Hill-Burnett
University of Illinois
Urbana, Illinois

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9

Our charge and our intent was to study science education. Often the science story seemed to shrink to insignificance beside other stories of teaching and learning in the schools.

It was not unusual to hear a teacher say something like:

> He's not a bad boy, and his family does care. I think the three of them just got into something. Anyway, I told him I was sorry it had happened, too. And I was glad about the apology. . . . It is so hard, though! They aren't bad children. . . .

It could have happened in any of our sites. But in Archipolis it happened so often! The weeks were strings of confrontations and reconciliations, beaded with smiles, taunts, curses, and embraces of one form or another. Most of the time adolescents and adults treated each other with warmth and openness. But exuberance and disregard for authority brought confrontation. At BRT, perhaps once a year in the whole school, a youngster might openly defy a teacher. In Fall River each teacher might expect such a disturbance sometime during the semester. In Archipolis, much, much more often.

Perhaps part of the reason is that the disciplinary system is inconsistent. Perhaps part of the reason is that the stated expectations for student learning are unrealistic. The reasons are not clear, and this case study will not explain the disparity between the code of behavior adopted by the schools and the actual behavior. What is crystal clear is that the confrontations sap the energy and consume the time that should be spent on lessons.

Such problems are not the sort of thing a school system likes to put on display. Observer Jacquetta Hill-Burnett was not warmly welcomed into the Archipolis schools. But the concern was for the safety of a young woman perhaps unacquainted with the ways of the city. When she told of her years of work as an urban anthropologist, they were not persuaded of the wisdom of her career choice, but they generously consented to her visit--hoping, we are sure, that the airing of distressing problems would win support more than censure.

"The worst is over." "We got it turned around." "We're doing pretty well under the circumstances." And they were. The circumstances were debilitating. Lab materials, textbooks, and demonstration equipment were inadequate. The teachers were capable enough in academic mathematics, but not able to overcome the obstacles to classroom learning. The "back-up system" was thin--when someone was unable to do the job, no one automatically slipped in to fill the breech. (When the nurse was not on station, a foot showed up on the high school principal's desk for removal of a splinter.) The more able students. . .

Perhaps too much is being said too soon. Better to get it directly from Field Observer Hill-Burnett.

SCHOOL SCIENCE IN AN EASTERN MIDDLE SEABOARD CITY

Jacquetta Hill-Burnett

The people in the schools of Archipolis are not at ease with the day-to-day conditions of work and study in the school, judging by observations in one school district of that city which serves a relatively large proportion of poor in its constitudent population. The personnel in the school are under duress. The organization they work in has been severely affected by budget cuts; loss of student population; materials distribution problems; court decisions that enforced equalization of teaching resources, but introduced guidelines contradictory to those of federally-funded programs; court decisions that forced mainstreaming of all kinds of students; the general poverty and high unemployment rate of the parental constituency of the public schools; ~~the high crime rate of the parental constituency of the public schools;~~ the high crime rate, particularly vandalism and theft, that is often a counterpart in urban settings of those economic conditions; and by a system heavily dependent on federally-funded special programs characterized by short-term abundance followed by reduction, squeeze-out and pull-out for national, rather than local reasons. Some of these problems are more salient than others in school peoples' talk. Some of the stresses are wretched puzzles to which they have no solution, and about which they feel hopeless. Many people in the system seem not to feel the stresses to the same degree. The principals suffer the pressures of middle positions, facing in several different directions and, thus, often not viewing or being able to view things from the same perspective as the teachers. But teachers are parcticularly burdened and particularly desirous that the very difficult circumstance of their work situation be candidly and honestly reported.

The corpus of data on which the research is based consists of data from four and one half weeks spent on interviews and observations in five schools with teachers, students, administrators, and support staff (counselors, hallguards or principals' aides), and in the homes of some parents. The reading, writing and lesson materials were important "artifact" data. On an extemporaneous basis I also interviewed taxi drivers, bus drivers, gas station attendants, store clerks, and city government officials. The daily newspaper was another important source of city-wide information on schools. I reviewed demographic and statistical data on the school system available in the offices of the board of education as well as reports and studies done on the school system by outside agencies, including private agencies.

In order to manage highly distilled reports of ethnographic case studies with coherence, one must emphasize perspective and theme, rather than wide-ranging detail. The reader must take account of the bias introduced by virtue of using a selective perspective from which to present this summary account. In this case, that perspective is a simple one that revolves around the question of what it takes to carry out a given activity, or set of activities, in certain ways to accomplish certain purposes. This means one considers intentions and wants, i.e., people's purposes, as well as the resources of time, space, materials, information, and social relations necessary to conduct activities in certain ways. If science in schools is viewed as a kind of activity in which certain people participate, then it is seen as actions of individuals which require certain kinds and amounts of materials, certain allocations of time and space, and certain meanings being attributed by participants to the actions and materials. Part of the meaning comes from people's purposes. It comes from what people want and what they want the activity to accomplish. Other aspects of meaning attached to activities come from past experience, particularly including experience with social groups and their shared meanings. As they do for any other activity, participants have views on carrying out science activities in certain ways.

The science curriculum, then, may be thought of as a kind of activity, or a subset of activities, that takes place in the context of many other kinds of human activities comprising the organization known as school. In this study the National Science Foundation specified which kinds of activities were going to be counted as science: activities with knowledge content of physical science, biological science, social science, and mathematics were to be the object of the research. By implication, activities that did not include at least some of these knowledge features were to be regarded as "not science" for purposes of the study. Because, however, other events or activities might have bearing on science activity so defined, other activities and their conditions could not be ignored. Indeed, the district locale and school locales of this ethnographic case study in Arhipolis were deliberately selected to look at school science in a setting that included a large proportion of low-income people in its constituency.

MULTIPARTITE PERSPECTIVES

Using the activity paradigm to approach the study of school science showed, not surprisingly, that the nature of science activity varied depending upon the level of the grade system one looked at. The relationship among the various types of science --mathematics, physical, biological and social sciences--varies not only by elementary, by junior high, and by high school level, but also from school to school of the same level, depending upon conditions such as student behavior, allocation of resources, district program thrusts, and some complicated relationships to the constituent populations of the school in question. Events and conditions look different from the point of view of different sets of people in different segments of the school system. Different views of issues arose from the roles of student, teacher, and administrator. Differing perspectives arose not only at the different grade levels of elementary, junior high and high school, but also from local office, to district office, to central board offices. Parents may be thought of as an adjunct or tangential part of the system. With views different from, as well as overlapping, other segments of the system. While community is often thought of as a residual segment, in this case agencies such as child welfare, police, and health agencies are salient components of that category. The emergence of the courts as a significant participatory segment is a portentous development for most urban school systems, and particularly for this one. The courts can no longer remain an undifferentiated part of the community in relation to the school. Thus the courts and service agencies were forces emerging out of that residual community sector that had gained power and salience in the schools, and with whose impetus school people were now trying to deal.[1]

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[1] One of the empirical drawbacks of a short-term study is the lack of time to check out events and issues from the various views from various postures in the system. Differing views often form patterns, even contradictory and contrasting ones, that make sense of variety in the processes of the system. While this report is weak in reflecting properly the multifarious points of view and interpretations and accounts of events and issues that are part of this complex system, in so far as different perspectives can be reported, they will be noted with as much accuracy as was possible, given the restraints of time.

The interviews which began with junior and senior high science teachers turned up the widespread view that in the elementary school, the amount of science activity and the way science activities took place is very much dependent upon the characteristics of the teachers. (They believed) students' experience with science largely depended upon the classroom teacher's individual background in science, and confidence in doing scientific activities and in doing scientific thinking. Yet, interviews with junior high students revealed that they didn't necessarily see their contact with science in school as limited to their classroom teacher's predilections, but often remembered visiting "teachers." Some contacts came regularly and some came from time to time. Students often recalled special science events and programs: particularly here, a science field-camp. This perspective (from several students) brought into focus the question of a history of the process of providing supplementary and supportive personnel for science activities. The issue had wide-ranging ramifications and connections. It was viewed differently not only by school level, but also by position in the hierarchy, from student to teacher to the higher levels of administrative staff and the central board.

From the teachers' point of view, before the "decentralization plan" had gone into effect, the central board of the school system had provided "department" (translate that subject-matter) specialists to go to local schools. Their activities and functions had varied somewhat from elementary to junior high, to high school. At all these levels, the teachers now expressed some sense of loss about those functions. They still dealt with the district office for support personnel; but the support personnel were no longer categorized by subject, or "departmental," specialization. They further saw the process of securing help from these personnel as a question of new competition for resources, perhaps challenging budget priorities in the local school. The personnel of the central board office did not see the history of the arrangements for subject specialist support in the same way at all.

From the point of view of some personnel at the central office, curriculum development and decision-making had been too centralized and too narrowly based. In order to place responsibility over support resources closer to the teachers, a number of reforms took place. Among these was locating support specialists in district offices and discontinuing organizational boundaries based on subject matter. The decision about when to call the support service was transferred to the local school and the teachers in it.

The teachers and principals seemed to appreciate the effort toward decentralizing decisions and responsibility. But the new system also left unfilled certain functions performed by the old system. The high school teachers missed the information resource service that central subject-matter figures had readily offered. If a question had arisen in the past, one knew not only where to call but also whom to call. The specialists "dropped by" with news of new curriculum materials. The elementary and junior high teachers recalled that teaching materials used by the specialists in demonstrations were then left to be used at the school. After decentralization, the teachers missed this extra resource. (One might conjecture that all did not benefit equally in this dispersal. But that is another issue.)

Finally, the elementary teachers saw priorities in decisions about resources as integral to the new arrangement. In their view the allocation of funds to science specialists now had to compete with other activities in their schools. The reality at the elementary level was that science activity was in competition for time, space, and budget with other subject activities more closely associated with the idea of basic skills. Social studies benefitted somewhat because of its use as content for the exercise of reading skills. But in a "money crunching district" (as one junior high principal described Archipolis) and in these money-crunching times, the competitive position of physical and biological science has become marginal in the elementary school. Just "how marginal" is only increasingly clear as one locates other factors adding to the competitive intensity.

> *Actually I really enjoy science. But I haven't had the time, with all the other things to teach, to put time into developing a science activity. Actually the children enjoy it. We sent the children to the environmental lab and they came back bubbling. EPA puts it on. But with the press of other things, I just couldn't take up on that.*

The teacher quoted above went on to say the Equipment/Media Center would be an excellent place for science projects. In this instance, lack of time resources, not lack of material resources was said to prevent physical and biological science from becoming a regular part of the curriculum. By contrast, in the elementary as well as the junior high schools, mathematics enjoyed a competitive advantage because of its association with basic skills. Mathematics, along with reading, received extra support through Title I funding for hiring remedial specialists to work with children at selected grade levels.

Mathematics, or arithmetic, seemed to be part of the daily routine of all the upper-primary grades I saw. It was also part of the routine of the lower primary teacher I visited (she taught first, second, and third grades). On the wall was a chart on ordinal numbers that (she explained) was part of first-grade mathematics. I asked her about the view I had heard expressed by junior high and high school teachers that elementary school teachers don't really work on mathematics, unless they happen to like it. She replied:

> *Oh, but I can't see how any child can leave elementary school without knowing how to add, subtract, multiply, and divide, at least with whole numbers.*

She went on to explain (paraphrased from recall):

> *Some teachers we have are afraid to teach mathematics. They don't know enough about it, so they used to rely on departmental resource people. Now they have to rely on themselves more.*

Competency-based curriculum objectives were being introduced actively throughout the school system, in part to assist teachers who "now had to rely on themselves more." A manual of objectives of skills and of knowledge for all the subjects and all school levels was being developed and distributed by the central board offices. Teachers' meetings were being held to plan local school programs and efforts that would realize the objectives. For example, in a given school, physical science teachers and social science teachers formed separate work groups, each of which took the list of skill and knowledge objectives from the manual of competency based curriculum objectives and discussed the constructing of lesson plans and teaching materials that would realize the competency goals. The physical science and social science teachers seemed subdued by the enormity of the task before them. Mathematics teachers and English teachers seemed more comfortable with the undertaking. They were using previously developed standardized, criterion-based, diagnostic tests to locate "weaknesses." As one elementary teacher explained to me, mathematics tests are given in October and they ". . . get results; we build our work around that and then they [students] are tested again in April . . ." Thus, elementary and junior high school teachers saw the skill and knowledge objectives already translated into diagnostic tests, and set about using them in that way. They felt they could quickly find out where the children were among skills and knowledge competencies, and thus could efficiently organize lesson time and effort around accomplishing specific competency objectives.

Poor literacy and inadequate reading skills were constant concerns and objects of teacher complaint through all grade levels, for all subjects--math as well as physical science, and most pointedly, social science. Grade school teachers emphasized that reading and social studies must begin close to the daily experience of the children. They said that many media of "taking-in" information--film, tapes, pictures--must be used together to provide a more meaningful context for reading. I asked about claims by junior high and high school teachers that learning to read is often not being accomplished in elementary schools today. The elementary teachers emphatically insisted that teaching children to read is a never-ending process. Children don't just learn to read for all subjects for all times. These teachers countered with the contention that upper level teachers often want an easy time of teaching, throwing a book to the child and having the child do all the work. They do not see the high school teachers employing various media and methods to teach students to read new content areas with understanding.

Many, but not all, junior high school scoial studies teachers and most senior high school social studies teachers regard the developing of reading skill as necessarily prior to learning social studies. One junior high teacher expressed the view this way: "Let's be honest about what we are doing. If we are teaching reading, let's call it teaching reading, not social studies."

In their staff discussions, junior high social studies teachers, too, acknowledged the "motivation" potential in using the everyday life of the student to teach about social studies. They faced a motivation dilemma with poor children from minority areas of the city. An older teacher with many years of experience declared (paraphrased from recall):

> *Sure, I can teach the social studies of the ghetto, and limit their words to the jargon of the street. Fine. But what are they going to do when they meet the wider world beyond the street? How are they going to talk and what are they going to talk about?*

The pedagogical reality says "Use the material of their daily life." The political reality of the ethnic group says, "Dare you, if you care what happens to them?"

Perhaps one never senses how basic the basics are until one tries to teach a group of students, many of whom are without the basics. In junior high math classes Miss Matlan found children who "did not know how to add and subtract, let alone multiply." She told me that one can't just "naturally" teach someone who does not know how to add and subtract, the fundamental understandings of arithmetical processes. Remedial teaching was, to her, a real and difficult skill that one had to be trained to do. She displayed profound respect for the ability of elementary school teachers who know how to teach the fundamental skills of adding and subtracting. Miss Matlan was teaching seventh- and eighth-grade classes, except for her home room, and ninth-grade class. One could describe the kids in ninth-grade class as "kids with big problems with their basics." Some who aren't so bright and others who are bright are so heavily into the "street" system of social relations and so under peer-dominated social control that they are lost to the activities of the classroom. After observing this group in class, I would venture to say that judging accurately the intellectual character and potential of children in a class like this one is not easy. The force of the social behavior on the situation is so pervasive that divining how certain students might behave intellectually, were classmates behaving differently, is more flight of fancy than diagnosis or prognosis. As I watched Miss Matlan teach math to this ninth-grade group, my respect grew for her skill at maintaining work-oriented social organization. With decided interactive and verbal skill, she kept an essential control without stifling the students. She also kept them working at their math assignments. The kind of physical and emotional effort her skill involved simply cannot be appreciated fully by those who have never had to deal with this kind of social environment for teaching day in and day out. Miss Matlan works for developing understanding of concepts underlying the meaning of what they are doing. For example, she insists that their math papers carry a topic title, a symbolic label for what they are doing. Sometimes she has them write out in prose the sequence of operations they are following, the relationships among the components of a concept, or the rules governing operations.

Not everyone would be pleased with Miss Matlan's teaching, or with the other math classes of this urban community. Different people see insights pursued and opportunities missed. These are some of the many multipartite perceptions in this complex situation.

TEACHING SCHOOL SCIENCE

Teaching science-as-inquiry through discovery, or learning science by doing what scientists do, was not widely practiced in the classrooms I observed. Of course, teaching science-as-inquiry does not require that it be taught by a discovery approach. If a teacher teaches that science is tentative and flexible and how scientific ideas are generated and tested, so that his/her students deal with scientific knowledge from these perspectives, then surely, by whatever means, a teacher has taught the students to understand science-as-inquiry. Nevertheless, the most ubiquitous emphasis that I saw was teaching about "what is known" through concepts, the standard labels, the meaning or definition, context, and the significance. Although the discovery approach was given wide verbal credence, only a few science teachers employed it regularly in their classes. Even they did not employ it with all classes. Discovery learning--whatever its final payoff for understanding science--is difficult to employ from the point of view of materials resources, self-directed social organization by students, and reliable sequencing of day-to-day classes. The subsequent discussion will show how the social context can hamper and prevent the use of such an approach on a regular basis, and may favor other approaches to the teaching of science in some schools.

In two different junior high school settings, a seventh-grade "astronomy" lesson and a ninth-grade social studies lesson, I saw deliberate and thoughtful emphasis on how anybody, including scientists, might come up with ideas about how things are, how one formulates ideas about them, and how one explains them. In Lincoln Junior High School, Mr. Nicollet started the discussion with the question:

> *How many saw Venus last night? Who wants to draw where they saw Venus? (He gets two quick volunteers) . . . What was the phase of the moon?*

Three students drew their observations on the blackboard. They compared their representations with each other and with sketches other students made. Questions arose about the nature of the phenomena of moon phases versus the question of how to represent accurately what is happening. They agreed, with the participation of the teacher in the discussion, to observe and record their observations once again that night in order to answer some of the questions raised in the discussion. Further discussion followed, reaching questions about the solar system and exploration of outer space. Mr. Nicollet introduced material from the text book, then said:

> *Look, this book is out-dated now. It was published in 1974. When did we land on Mars? (pause) . . . The information in this book is inaccurate because these were guesses. It . . . [was shown to be wrong] . . . Don't just believe something because it's in a book. [Just because] information is in books means nothing. Believe your experience!*

The other example occurred in another junior high school. The lesson was drawn from a locally developed social studies curriculum on local history. This particular lesson was about plans to go out and observe. Mr. Zerlof first asked:

> *What have you observed about conditions in the neighborhood? If you want changes, who do you go to see [to complain about them]? How do you describe what you have observed so they will know what you are talking about? . . . so they'll believe you? So they won't be able to deny it, just by saying it isn't true!*

After students described some things that are bad about the neighborhood, Mr. Zerloff asked:

> *What are you going to do about it? [If you're] going downtown to tell someone about the neighborhood . . . [you have to] go to the right people . . . [you] have to be very observant and very fair. If you do these things intelligently, you can get things done.*
>
> *What is observation? Now close your eyes! Close eyes! Mattie, your eyes aren't closed. You're peeking. O.K. Everyone's eyes closed? (He moves to tha back of the room, in behind all the seats.) Now tell me, what am I wearing today?*

And so it went, 'til one boy gave a complete account of all his clothes, down to the shade of the suit and even the heels on the teacher's shoes.

After further discussion of neighborhood conditions, they turned to questions of ways to represent their observations. How could they formulate what they observed? One way was mapping.

> *Right! O.K. Draw a map of this school, the exterior and surroundings.*

There was some explanation, but the main idea was "doing it your way." So they set about constructing maps of this familiar territory. Almost immediately, questions of perspective and scale came up: what to include and exclude offered excellent mental ground for questions of formulating knowledge, the relationship to purpose and problem, and the necessity to reduce and simplify, etc. The teacher discussed perspective, urged them to finish, following their own immediate preferences.

Other examples of discovery inquiry teaching were observed in a high school biology class and in a special afternoon discovery-oriented science workshop, both of which will be described later. More commonly, the conduct of classroom activity reflected the dominant pattern of concept learning through reading. Reading was Ms. Odom's predominant emphasis in her teaching, although she also conducted demonstration experiments for her classes. The classroom's furnishings and equipment fit demonstration teaching. There was only one science table and sink, located at the front of the room. The students sat at individual desks and chairs. Thus, a widespread and common mode of classroom science teaching can be illustrated from the field notes on her class.

Ecology and life sciences seemed to be the favorite topical emphases in both elementary school and in junior high general science classes. There is evidence that the teachers capitalize on interest stimulated by and contexts provided by the mass media.

> *February 16, 09:30. (Arrived late; taxi problem.) Books are out (Chapter One of Life Science by Wm. Smallwood, Webster Div.: McGraw-Hill, n.d.). Twenty-one kids in the class. Ms. Odom doesn't sit down. She moves about the classroom, or stands, or leans against the window sill. Students begin reading out loud from the book. There is a kind of dialogue. (I do a sketch map of the room.) On the blackboard is the following:*
>
> *Feb. 16 7-204*
>
> > *Life Science, Chp. 1*
> >
> > *Objectives: to learn what the life scientist does when he works.*
> >
> > *1. What is life science*
> >
> > *New words*
> >
> > *1. biology*
> > *2. predaceous*
> > *3. data*
> > *4. experiment*
> > *5. observation*

Ms. Odom: Don't laugh when a person pronounces a word wrong. (The word is predaceous). Let's discuss "predaceous." Has anyone heard the word "predator?" (A child in the third seat, second row, answers "I have," but his voice is low. I can't hear him. They go on.)

T: What is life science?

S1: About animals.

T: O.K.

S2: About insects.

S3: Branches.

T: What?

S3: It's about branches on trees.

T: About all living things.

S2: About people.

S3: . . . Plants.

S4: About environment.

T: OK, you read. (she points to the child in the seventh seat, first row. He doesn't want to read. Ms. Odom calls on another student. That student, fourth in second row, reads.)

T: (in an encouraging tone) Talk louder, little girl. (Student reads louder)

T: Remember our objective this morning is to learn what a life scientist does. (They stopped reading just before they got to the section on data and experiments. Later Ms. Odom explained to me that since time was nearly up, she chose to stop there and would go on the next day with the section on data and experiment.

T: There are three words we will never forget . . . (pause)
life; plants; animals.
(She told one of the students to take up the books.)

Her next class illustrated the next phase of this cycle of the assign-recite-test-discuss pattern of teaching-learning events. In the test stage of the cycle, students start the period by taking a test on material they have been assigned to read and which they have read aloud in class.

As the students enter and gradually settle down, Ms. Odom directs their attention to the blackboard, where they see the following written:

Feb. 16 8-216

Chap. 3: Ecosystems

Review Test 10 minutes

1. What is a population?
2. What is a habitat?
3. What is a niche?
4. What is a pest?

Ms. Odom writes "10 minutes" on the board.
T: Don't write the question; just write the answer in complete sentences. You hand things in and I don't know what you are talking about. (Ms. Odom begins to take attendance. She finishes the roll and writes on the middle black board:)

> Chapter 3, page 39
> Ecosystem

On the board next to it she writes:

> Homework: Watch, 7:30 tonight
> "Wild Kingdom," channel 4
>
> 1. Name the population.
> 2. Name the habitat.
> 3. Describe the niche.

S: What time is it?
T: It's time to finish. Put your names on your paper and pass them to the front. (Books are passed out. As they are ready to begin, Ms. Odom asks:)
T: How do we learn?
Student chorus: We learn by reading.
T: We'll let a reading team read to get through the reading quicker. (A set of about five students begins the reading. They read about community.)
T: What is a community?
S: A group of a population living in a particular area. (He reads this nearly verbatim from the book.)
T: What is a population?
S: A group of plants and animals.
S: (Seventh in second row) Population is a group of one kind living in a given area.
T: (turns to another student)
S: A group living in an area of one kind.
T: A group of one kind.
S: (Seventh in second row) That's what I said!
(I shake my head "yes." I got excited by the slight, too. Ooops, teacher sees me!)
T: Is that what you said? I just wanted to make sure everybody understood. (Ms. Odom writes "community" on the board. The students start giving examples of habitat; she writes down everything they offer: pond, forest, soil, tree, mud puddle, river, mountain, cave, desert, ocean, lake, jungle, lily pad, stream, rotten log, Coney Island [gets a laugh]).

These class scenes were my first classroom observations. They proved to be fairly representative of classroom activity in most of the classes I saw. Naming and defining were the main focus of the approach. In most classes I observed this seemed to be a central concern, with a few observed exceptions, even when the activity was a project, or "experiment." Ms. Odom handled it well. In Ms. Odom's classes the students were interested in and found rewards in this style of conducting science lessons. Nevertheless, as will be clear later from their interviews, the students prefer a less book-oriented classroom style. Reading aloud represented a tried-and-true procedure for dealing with many students' poor reading ability and assured "academic engaged time" (see Rosenshine and Berliner, 1977). Certainly it would be inaccurate to say that Ms. Odom did not teach that science is inquiry. But it would not be accurate to say that she taught science-is-inquiry by using a discovery approach. She was superb with the social organization of seventh- and eighth-grade classes to be taught with a heavy textbook emphasis. Yet, all her ability at organizing classes to get down to work did not shield her from disruptive behavior. She reported students had walked across the desks and yelled insults and curses at her. Only in retrospect did I begin to fully appreciate how her skill at social control enabled the serious students in her classes to get on with their work.

The two high school biology classes I saw revealed "hands on" activity as a regular part of at least one teacher's approach. Cultures in Petri dishes, comparison observations over time, and "control" compared with "experimental" specimens were main emphases of this teacher's classes. By the time I came to this class, I was acutely aware of shortages of materials for conducting everyday "hands on" work. Thus, as Mrs. Xeum gave out fresh mushrooms for the next biology lesson, I wondered whether she had "bought" the mushrooms herself or whether there was a reliable quick source for such perishable materials. Subsequently, I learned from the high school principal that a per pupil allocation was made each year for "perishable" supplies like those mentioned for biology. The head of the science division, Mrs. Yeager, suggested that small supplies of that order weren't a problem. In the high school the real problem, she said, was the large-scale costs of renovating the science rooms so classroom activities could be organized to better simulate science laboratory research.

Ten or so high school students were being trained in an afterschool workshop to work with young children in an inquiry/discovery science museum. This was to be a summer job for them. They were learning how to do their work in part by doing the "experiments" that they would later do with young children. My observation of the group suggested they were not yet practiced in the intellectual process of formulating, testing and eliminating explanations in association with manipulation activities. Some students were very good at carrying out the manipulations, but the intellective part of offering an explanation for the phenomena, and then retesting to try it, or to modify it, was not something they did readily or easily. They were motivated; but the refined art of inquiry was not yet present in their actions.

STUDENTS MAKE A DIFFERENCE

Mr. Zerlof, the junior high school social studies teacher described earlier, was an excellent teacher. He had attended social studies training institutes but never an NSF Institute. He was working on a "local" district-financed curriculum project that included selected junior high social studies teachers (including himself) and a few local university social studies specialists. The project group had developed a "local city history" curriculum that began with the present and then moved back in history. Thus, the teacher's ability and experience, as well as good curriculum ideas and plans, contributed to the exceptional scientific quality I observed in the classroom lesson described earlier.

The assessment of the sources of excellence must not neglect the quality of the behavior and skills of the students in the class group. The kind of students that made up the class significantly affected wht did and could happen. It could influence whether a teacher would try out new course materials with them. The contribution of the students to the excellent quality I saw in the social studies lesson based on this local history curriculum, I would venture to claim, was a behavioral contribution. As a group, it was a peach of a class. Among their members were highly motivated, extremely bright young people. After the social studies session, I saw this "peach of a class" in general science working on science fair projects, and another time, in math class. But my most striking encounter with them after the social studies observation was in their science classroom, when I suddenly realized that several of the students were speaking Spanish to one another. I began to talk to the four or five boys, two in particular, in Spanish, to find they had been studying it for only six months. Not only had never a one been in a Spanish-speaking country, apparently not even in a Spanish neighborhood, but they were being taught Spanish by a math teacher! In a school in a very poor urban neighborhood, this intellectual "oasis" had taken shape. How teachers responded and worked with them gave one some idea of the enthusiasm and effort teachers were capable of when not beset with student conduct and heterogeneity problems.

A natural, quasi-controlled observation opportunistically allowed a demonstration of how students influence the performance of teachers. The same social studies teacher taught both the "top rated" ninth-grade class, and the ninth-grade class that "seemed never to bring anything off right." This class was a mixture; eight to ten streetwise kids; a few already accomplished entrepreneurs of the ghetto; a few serious students; and the majority, youngsters whose most common response to school "opportunity" was lethargy. Even lively, hard-working, articulate Ms. Matlan, with valiant effort, could not seem to change their momentum. Pep talks "All right. Class 9-28 is good, but you can be, too!"

She reminded them of the reality of life outside school . . .

> *If you're applying for a job and white applicants also show up, you don't get the job if you are only as good as the white applicant. To get it, you have to be better.*

And she resorted to (would you call it?) bribes. . .

> *I've gone out and bought graduation gifts for them. They know about them. I told them I wasn't giving anybody a gift who doesn't actually graduate. And a lot of them aren't going to, unless they get with it and settle down to work. But they are preoccupied with the prom; and since they've always been passed in the past, they all are sure they are going to pass this time. I don't know what's going to happen to them, though.*

"This was the class that I wanted to see under Mr. Zerlof's tutelage, so as to compare that event with the same teacher teaching the class for which everything seemed to go right. Mr. Zerlof had been absent the day preceding the afternoon I came to observe. The "mixture" class had worked with a film strip but had not been reminded to bring their work to class, so Mr. Zerlof had to improvise. He did so by passing out an Afro-American newspaper and assigning the reading of the frontpage lead article on the ethno-historical question of pre-Columbian black presence in the new world. Despite the esoteric subject, he showed his mastery of the art of teaching, winning a lively response to reading aloud, locating key words they couldn't pronounce and didn't know the meaning of, pronouncing and defining them.

> *Hold it, Hold it, don't interrupt Morris! You are trying to steal this man's A. Don't do that! He needs it!. . .(Knowing laughter from the rest of the students. They were with him now. There was "property" to be won in pronouncing and defining!)*

Why this kind of lesson? Why not the city history curriculum? These kids could really liven up things when it came to observations on this very neighborhood. Indeed, some of these kids are probably part of the problem that other kids in the other class were spelling out. True, the content of their "now forgotten" regular lesson on Afro-American history might well have been more relevant and exciting than this esoteric newspaper "special feature." But the circumstance, that one couldn't count on what would happen with this group "who never bring anything off quite right," is probably the reason for not trying out a new trial curriculum with them. Probably they would forget their work, throwing the trial use off-course, spoiling the whole effort. And finally, as Mr. Zerlof himself observed, they couldn't read with enough skill to try out the material for a more general population of students.

One could not count on "proper" conditions for doing what one intended. Preparation for a class often had little relation to what a teacher actually did. Disruption, repeated disruption, interfered. Consequently, an enormous amount of effort by teachers, principals, and aides was invested in policing "non-selected" sections of students, in reacting to misconduct and verbal transgression (including verbal abuse), and at least containing them, if not controlling or eliminating the behavior.

SELECTION

Deliberate selection of children to form homogeneous classes has been declared illegal by the courts. Nevertheless, "selection" occurred "naturally" with the level of difficulty of the subject matter, such as in junior high algebra versus general math, or biology versus general science; or in high school Biology I versus Biology II, or applied math versus Algebra II.

Selection helped make learning conditions better for the more capable students, poorer for the less capable. The latter often resorted, then, to disruptive behavior; but banishing misbehaving students could be more disruptive than keeping them. The banished returned, very often filled with resentment and intent on revenge, though confident, too, they would be once more punished. Teachers are a key ingredient to a successful classroom, but they seem to have no greater impact than has the interest-in-learning of the classmates.

Just as much as are materials, social relations and personal conduct are critical parts of any curricular activity. "Mainstreaming," so called, mixes not only children of various abilities and competencies, but also children habitually using diverse modes and forms of social conduct. Disruptive modes of conduct directly affect the ways teachers carry out science activities. Symptoms of stress and low morale were observed in many Archipolis teachers. My observations led me to conclude that those "privileged" to teach class sections selected by the curriculum's "naturalistic processes" (such as only students passing Algebra I), did not show the same air of fatigue and harrassment, although there was still an air of worry and disquiet about their manner. In a meeting prior to the initiation of the research, the high school principal pointedly suggested that I be sure to take note of whether each classroom I saw was one of an advanced selected group or was one of the general classes that everyone must take. In the high school, "selection" did make a difference about how much teachers contended with behavioral disruption. Though less often discussed as a salient problem by the "advanced" teachers, lack of student commitment to school was frequently emphasized as a major problem in the beginning high school classes. The fewer "unselected" classes and the more "advanced" science classes a teacher had (when asked about problems), the more he/she stressed lack of resources and the poor level of motivation of students. In this context, motivation meant unwillingness to do or learn anything ". . . unless they got a grade for it. . . ." Students seemed unwilling to work to learn something--according to one high school mathematics teacher and several junior high school mathematics teachers--merely because it contributed to the excitement and ease of learning.

One math teacher complained of difficulty in getting them to think, to use their judgment, to use "sensible" estimation to test if they were going in the right direction. "They operate by role; preferring routine, set procedures that they automatically follow rather than sense and logic." She wasn't "put out by new math." She felt it is important to introduce theory along with operational ability. This included introducing probability in the applied math class with "craps," the object being understanding and not morality. Actually, in her view, there was a "trend going on. Overall, students are not performing as well as they have in the past." Some students were lazy. Some of them should have been in an algebra class instead of a general math class, but they just didn't care about putting out the extra effort. Other teachers also complained that capable students often did not take advanced classes because they were reluctant to put out the effort. The disquiet and worry noted among high school teachers, speaking thematically, reflected dissatisfaction with lost potential and talent.

There was also heavy emphasis on the mysterious lack of skills and flexibility in applying what students knew in one context to a new or different context (the process of "transfer" as opposed to the process of "mastery"). One way to think about it is the way the high school principal talked, when he referred to the extreme compartmentalization in the subject domains on which the children work: "The knowledge gained in one class is not used to supplement, complement, or add context to the subject matter from another classroom setting." The extreme of this process is the tendency to compartmentalize each lesson forgetting one when going on to the next, so that every "topic" is unrelated to the next. Even inside a single classroom, compartmentalization from lesson to lesson seemed to occur. Miss Matlan told her general math class: "When I give you something new, you forget what you've done before. And all those things are interrelated. . . ."

BEHAVIORAL DISRUPTION

Testimony before Senator Birch Bayh's committee hearings recently indicated that the concern about undisciplined behavior in schools is a widespread concern in our society. The junior high teachers in the Archipolis system were weary of "policing" (their word) the behavior of many of the students in the five or six sections of science each teaches. They perceived that only some of the students caused disruptions that affected all the students. In their view, the problem was that they couldn't remove the children who did cause trouble, so that those who wanted to work could work. Thus, much class time was spent in making the students conform to a behavior that allowed students who wanted to, to learn. There were classes that were exceptions. Teachers looked forward to teaching these groups. As far as I could judge, these were the students on whom they expended their best effort, and on whom they tried their "newest" materials and most challenging ideas.

The preoccupation with student conduct and social control took a heavier toll of time and energy in some schools than in others. In the classroom, "policing" refers to controlling loud raucous behavior, noisy verbal combative prattle, disruptive talking, loud comments, talking back to the teacher, insulting other kids or the teachers, and physically moving around or in and out of the room without permission, and sometimes contrary to directions from the teacher. These effects are more likely to be present in junior high school than in senior high school. They are less likely to be present in selected classes involving advanced accomplishment. Policing was most likely to dominate teacher effort where a section or class was taking remedial work.

Hall behavior in junior and senior high school, where students moved from class to class, was the focus of assistant principals, hall-duty teachers and principals' aides. Fast physical movement, labeled "ripping down the hall" in at least one junior high setting, led to the half-humorous advice "good luck and stay close to the wall." This physical movement happens in a sea of loud voices, laughter, slamming locker doors, and bursts of other sounds. Even while classes are going on, some schools have a particularly difficult problem with students who wander around the halls. Some are just tardy. Some are cutting class by hanging out in the halls. Some are chronic class cutters who wander about finding other classrooms to enter and disrupt. This seems to happen despite the control mechanism, particularly in junior high school, of requiring a permission slip for departing the room. Spending a day with a teacher gives one a clear sense of how difficult it can be to control the movements of older children with such traditional mechanisms.

When I spent the day with Mrs. Vought, I noticed she kept the doors to her classroom locked, even during some of the class sessions. At first I thought it was "fear." (This explanation reflected my typical outsider's over-reaction to hall behavior and to the frequent discussion of incidents involving either verbal or physical aggression.) But the lock was an effort to control another condition or force that interrupted class activity as it was planned by the teacher. If children wandered in the hall, cutting classes, the teachers, principals, and "hall guards" (my words) seemed only to be able to urge them to go to class. (e.g., Teacher to young boy as we walked toward her room after the period began: "Son, go on to class now. Why [rhetorical] aren't you in class? It's past the beginning of the class period.") Expulsion required a long history of transgression and abuse of the rules of the school. Official punitive action was not impulsive. There were always at least a few students wandering through the halls during classes, sometimes (often) stepping inside the doors of classrooms cheerfully to catch the attention of some student within.

During Mrs. Vought's class, for which she had prepared a discussion and project demonstration leading up to a whole-class project, I noticed the rising sound of conversation coming from the back of the room near the double doors. A young boy stood inside the door, at first talking, then arguing with a girl and several boys. Apparently an exchange with the girl had spilled over into verbal sparring with the other boys. The word-skirmish rose to a crescendo of sound until the whole class was caught up in it, totally distracted from their books, papers and from the discussion of the science lesson with the teacher. Finally, the teacher seemed to give up the idea that the episode would just go away! (Patience is an adaptive procedure one seems to learn to use in this environment, unless one's job is trouble shooting. Otherwise one would deal with nothing but trouble. In Van Dryck Jr. High School, you don't have to go hunting for trouble.) She called across the room to the boy to "go on out, now. This is class, and you're not supposed to be here." The noise of conversation subsided but he didn't go out, and he now had center stage. The "expulsion" process went on as the teacher moved by stages from the front to the back of the room. There was no militant charge. (How could she stand all this prolonged agony!) Finally she reached him, having all the while given voice to why his behavior was not only inappropriate but was leading to his own loss eventually, remarking that it shows how little he has learned from anywhere--either school or at home--about how to behave. Gently she pushed him out between the double doors, talking all the while . . . and locked the door behind him. So that's what the locked door means! To keep out hall wanderers--to cut down on disruptions.

By this time the forty-minute period was nearly gone. At the front of the class she said, "Let's get back to the question . . . ." And for a half-hearted five minutes, she carried on amidst a continuing buzz of student conversation. "All right, Jimmy Joe, collect the books" (they were working in Pathways to Science). After class, she turned to me, apologized, shook her head sadly and said,

> *I'm glad you saw it. Now you know what I mean when I say it doesn't seem to matter how much time you put into planning a lesson, how many hours you put into collecting enough staff together so the whole group can carry out*

> *the project. . . .You just never know what's going to happen. It is just wasted. So often it is just wasted. I get so tired. . . so tired of it.*

On another day I saw what the teachers meant when they often talked of lack of respect. I was in the class because I had returned to interview students; but another period began before I left, so Mrs. Vought invited me to stay. At long last I was to see a "project" activity. Two weeks before, this class had gotten excited about a unit on sound, particularly the result of holding a tuning fork against different sized containers of water. The floor had been a sea of wetness, but Mrs. Vought cleaned it up gladly. Moreover her account echoed with delight that they had experienced the kind of excitement toward science she herself had experience in an NSF Institute. She wanted them to experience that excitement, too.

The project guide for this eighth-grade session was in Pathways in Science. As she checked the roll, the books were handed out; just as the class was about to settle down, about two minutes after the bell, three boys sauntered through the door. She looked up and said,

> *"Where's your tardy slip?" Sullen silence. "You'll have to get a tardy slip," to which one of them said he needed a note. With this, they started to move to chair and desk--now less with an air of bravado and more with unobtrusive body English, to slip in unnoticed. "Wait!" said the teacher. "Come back up here. Stand up here by the door until I can get this note written." They moved, two with bravado, the third now trying to locate himself half way between the door and class, so if given a chance, he could slip into the anonymity of the class. Then began many minutes of mischievous and verbal exchanges, and with each exchange an escalation of feeling and more writing onthe note 'til suddenly the lights flickered off, on:*
>
> *"Who did that?"*
>
> *"I didn't. . ."*
>
> *"You did, Lynn."*
>
> *"Hurry up with your note; I want to go. . ."*
>
> *"Do you want to leave this class or stay?"*
>
> *"Yes. . ."*
>
> *(More writing, more light flickering.) "You'll not come back to this class without your parents' visiting."*
>
> *"Give it to me; I don't want to be in this fucking class!" (Simple, brief silence as she finished.) "Hurry"*
>
> *"Wait!"*
>
> *She went to the door, gave it to him. He was agitated now, and to her admonition to take it directly to the office he yelled back down the hall, "You get out of my face, you mother fucker, you!" A gasp and titter and loud laughter from the rest of the class. The other two boys were told to go to their desks as the class turned to. . .what? The shambles of "the planned lesson."*

Several days later, Mrs. Vought came into the teachers' lounge where I was chatting with two other teachers. She said "Oh, Dr. Hill, I wanted to tell you what happened with Lynn, the boy who behaved so badly the last time you were here." She recounted his return. He came back to apologize. He was really sorry. She said,

> *He's not a bad boy, and his family does care. I think the three of them just got into something. . .Anyway, I told him I was sorry it had happened, too, and I was glad about the apology; but I could only accept it if he offered in front of the whole class, because in a way he had insulted them, too. So he did do that and I gladly accepted the apology. It is so hard, though! They aren't bad children.*

In the junior high schools the salient issue was "mainstreaming": not so much random mixing of abilities, but the mainstreaming of youngsters with behavioral problems, "juvenile delinquents" as they were sometimes referred to. This was no small concern. Children were being returned to the schools, and to the same classrooms, by the court. A federal court decree assured these children the right to re-enter those classrooms. Following this legal mandate of the courts, the teachers of one of the junior high schools submitted a petition to the teachers' union to initiate a "class action suit" on their behalf.

The stress ran deep. One day I entered the teachers' lounge with Ms. Odom during her free period. I saw an older man with close-cropped hair sitting at the end of the table nervously smoking a cigarette. He held his head with one hand, stroking back across his hair from time to time as if to relieve it of pain. Whe introduced to me as Mr. Thomas, math teacher, he asked if I were there to introduce a new curriculum. I said "no, not this time." I was there to find out what was happening now in science teaching and what teachers thought of it, good and bad. He said:

> *You get kids and they don't know what they should know to do the work. Since they can't do the work, they act up. They don't want kids to call 'em dumb, so they act up to cover up the fact they can't do the work. . . They can't subtract and multiply. They know theory and sets but can't subtract. . . .New math seems to have done that; the paper says high school grads can't even read!*
>
> *Q.: Do you want to go all the way back?*
>
> *Mr. T.: No, not all the way, but some. . . Oh, I got a headache just looking at this school this morning. . .A kid said to me. . .pardon me. . .he said to me, "Kiss my ass!" Teachers have no rights anymore, only kids. (He rubbed his aching head and drew deep drags from his cigarette.) Kids are all mixed up now.*
>
> *Q.: Is it the size of the classes?*
>
> *Mr. T.: No, size isn't it. You can have fifty who want to learn and still have a good class. We're not allowed to group kids homogeneously. You'll have kids in a grade who can do the work, but some who are two or three grades behind in reading; you have to individualize or group. You can't teach otherwise. But you're just a security guard. (Then). . .Come to my second period class. I'll show you what good kids can do.*

PARENTS

Parents I found have strong sympathy and support for teachers in this matter. At the end of an interview with one parent, I quoted from the petition being composed by the junior high school teachers in the school her children attended.

> *The teachers of Roosevelt Junior High School request a class action suit to protect the rights of our serious students. The quality of education has been severely eroded by the behavior of a few students who make life miserable for the others. The noise, the commotion in the halls created by class cutters, distracts students from their work. Teachers are being verbally*

> *abused and physically assaulted by unruly students who cannot be expelled from school because of legal restrictions. Juvenile delinquents are placed in the schools by the courts regardless of their effect on other children.*

She listened, then shook her head and said, "It's true, that's how it is. . .I see it when I'm there. . ." The conversation went on, then ended with my thanks. At the next interview a few doors away, I found a similar sympathy and a further agreement that many parents don't assume responsibility for their children: "Half send the children to the teachers to raise 'em and learn them, too. Teachers have a job on their hands." Those two interviews were not arranged by the schools. The force of sympathy with the teachers' plight was remarkable to me.

Parents also had definite ideas about the curriculum. In junior high the children are asked what subjects they want to take, but one parent said it is

> *. . .learning to read and good spelling that matters most. They need that bad. . .and typing, they need that, too. Now the school offers most everything--if the children would take advantage. . . .Children are different now. I think they have a good opportunity if they'd just take advantage of it. . .they have more than I had. . . They've got it good if they'd just take it.*

Of the three science areas I mentioned, she felt math is more important than social studies or science. She added, "Reading is important. That is my idea. But they don't seem to read well enough for the grade." She noted her agreement with the practice of the past, that a child didn't pass until he or she "[got] it for certain." But "now if they hold them back, they get disgusted and pull out of school." Early in the interview I had asked her general opinion of school and how well the school was doing in the education of the children. "The teachers do most all they can do, but some of these children is another thing." Later when she spoke of how her children take advantage of the good educational opportunities offered them, she spoke of the need for parents and teachers to get together and talk and see what they can do.

The parents and teachers and students, too, are aware of the obstacles to learning and the disappointments of teaching brought about by student disruption. What is less realized is that managing a classroom to avoid or curtail disruption requires talents separate from the talents for teaching children their lessons. Since children cannot learn their lessons if the disruptions are not managed, those teachers who do not have the management talent are driven from the school. The shy math teacher finds it much more rewarding to work in the city assessor's office. The contentious science teacher is encouraged by the principal to transfer. Thus, the number of good teachers available to staff the school is further reduced.

STUDENTS' VIEWS

From the point of view of many students, the best "science experience" of their school careers was the several days they spent at Field Science Camp at Mt. Airy. References to this camp program came up again and again in student interviews. The field experience seemed to have brought home to every one the part that observation, in the full sense of description and examination, plays in biological and physical science. Its effect on the students apparently was lasting! Given its indelible effect on the minds of the children, if I were making recommendations regarding science in these Archipolis schools, I would say the camp should be the first programmatic effort to be extended, the last to be cut back. Indeed, every effort should be made to expand it and experiences like it.

In addition to recalling their trips to Mt. Airy, students shared their conceptualizations of "What science is" or "What kinds of science are there." Many similarities arose across the students' interviews. The most common response in junior high students was that "Science is everywhere, and includes everything." The students may not prefer the bookish study of science, but they don't conceive of it as simple word memorization. In response to a direct question on this, one eighth grader, seemingly somewhat puzzled that I would suggest that learning a word is just memorizing a definition, carefully explained to me that learning the meanings of these words involves learning more about the world, and more understanding of it. So, in my words, she was learning concepts and "conceptions" of the world around her, not just labels and definitions. It is well to keep this perspective--shared by many of the students I interviewed--in mind, should we feel tempted to denigrate the book-oriented style of most science teaching described here, as compared with an activity-oriented or inquiry-discovery style.

In response to the question, "Do you think as much of math as science?" three ninth-grade girls responded: "Yeah, in a way I do." But each had her own way of thinking, which reflects some of the procedural difficulties that curriculum developers experience in integrating the math and science teaching units.

S2: Yeah, because you have to know math so you can do science.

S3: Yeah, you have to know science in order to know math.

S2: You have to know math.

JH: You have to know science in order to know math?

(Chorus) S1: You have to know math to know science.
S3: Unhuh, cause. . .
S1: Some of the formulas. . .
S3: I don't think so, because everything in this world deals with science; anything you see.

JH: (Speaking to S1 and S2) But you girls think it's the other way around. You need math to know science?

S1: Yeah, 'cause the formulas. . .you gotta know some math in order to solve the formulas.

JH: Of all the things you've ever done in school in science, what's your favorite thing that you remember?

S3: My favorite was when I went to Mt. Airy (the camp).

JH: How about you. . .(S2)?

S2: I don't know. I like to do experiments.

JH: Any one in particular?

S2: I remember one this year. We had to measure the sand. . .and I liked the distillation of wood, too.

JH: You did? Did you girls get to do that yourselves or did you just watch the teacher do it?

Chorus: We did it ourselves.
There was two in a group and
they worked together. . .lab partners.

JH: *Now through junior high, have you done more things like that with Mrs. Vought than you have with other science teachers?*

S1: *This is my first time.*

S3: *My other teachers, they would do. . .my seventh-grade teacher really didn't do that much because he hardly came to school. My eighth grade teacher, he would do experiments but we would just watch. This year, we get to do experiments ourselves.*

JH: *So do you like that better than just watching or would you rather have the teacher do it?*

S1
S2
S3: *Unhuh (other comments that it's better to do them yourself).*

S2: *In the seventh grade we didn't do anything.*

S3: *Yeah, we had the same teacher.*

S1: *We just had work in books.*

JH: *Do you find most of your science in school has been that way. . .you read, answer the questions? How does it go?*

S2: *You take and read the chapter that's been assigned to you and then you answer the question in the back after you finish reading.*

JH: *And then what happens?*

S3: *You check the work.*

JH: *The teacher checks it? Do you then discuss it in class?*

S1: *If you don't understand it.*

The students also think of social studies as science. But since "observation" seems to be an important feature of science-like things, more detailed exploration of their models of science seems to be warranted in future research.

The "reading question" also had its student-oriented side. The students' views are not monolithic, but cover a range of perspectives. The modal position seems to be a preference for "projects" over "bookish" exercises. Their tastes run to a decided preference for "the multimedia" approach, as the following group conversation with an eighth-grade section reveals:

JH: *Suppose you had the possibility of getting whatever kind of science that you wanted in school, what would you want?*

S4: *Biology.*

S2: *Bunsen Burner Science.*

JH: *Like, if you could have it in junior high, what else would you ask for?*

S4: *I would say some kind of science that would help me with the job I want to get.*

S2: *Yeah, me too, me too. Like experiments.*

S3: *I don't like to experiment.*

S4: Yeah, I like experimenting.

JH: Would you like to work in a kind of laboratory?

Chorus: Yeah! Yeah!

S3: And have my own laboratory.

JH: And have your own laboratory? Well, that'd be really jazzy.

S1: I want to learn how to do blood tests and those things.

JH: What about going out on field trips?

Chorus: Yeah! Yeah! No school. Yeah!

S3: It'd be fun if you don't have to write nothing.

S2: Yeah.

JH: You don't want to write it up?

S2: Just observe, just tell 'em things.

JH: How would anybody know what you saw?

S4: I know, but. . .

S3: Take pictures.

JH: But you'd have to. . .take pictures.

S2: Yeah, use a tape recorder or something.

JH: Take a tape recorder or something?

S4: Talk, talk.

JH: Oh! So that's what you'd rather do. Collect your information and record it.

S3: I'd rather do something than just write it down as you go along to get it out of the way. . ."He done this and this and this."

JH: Well would you like to have tape recorders instead of books?

Chorus: Yeah!!!

S1: You can really hear it.

S2: Yeah, put it on your ear.

S1: Then you can understand it better than reading because they describe it in more detail than the book does.

S2: Someone won't interfere, right?

JH: What if you had those individual slide things so you can see pictures, too?

Chorus: That's right!

S4: I think you could understand it then when teachers say, "Read this! And read that! And write this down!"

S2: It's like somebody said, it's better for you to do something than it is to get it out of the book; the book doesn't give you all the knowledge.

JH: Umhum. If you could do those things, do you think you'd behave yourselves?

S2: Yeah.

JH: Honest, honest, honest. You think you'd be quieter?

Chorus: Yeah!

S1: You have to be quiet if you want to hear what's goin on.

Some student views range toward the elitist view that the problems with poor reading are due to "lower mental capacity of individuals." This view came from an exceptionally talented young ninth grader whose own experience was that "reading came naturally to him." His theory was that it should "come naturally" to most children of average or better capacity during the first and second grade. If it didn't, they were "in trouble." Actually, in the minds of some students, reading was inextricably interwoven with writing and written composition. This may represent a modal perspective of the students, since the "read-find answer-write answer-turn in written work" pattern of activity was so ubiquitous among all the classroom situations I observed. Take note, however, of the pedagogical theory implicit in the proposal of one of the boys in the preceding quotes. If he can compose his account of his observations on a tape recorder and then transcribe his account from the tape, he would be satisfied. The struggle with orthographic and formating skills seems to get in the way of his concentration on meaning. His solution is to separate the two problems. This technique, with refinements, is being used in many settings. There is wisdom in the minds of the children. Yet, given the previous account of the limited material resources of this school system, the marginal economic condition of the main portion of the population, and the constant daily presence of theft of property (an exchange the jaundiced eye of the anthropologist might see as an economic redistribution device in a politically disenfranchised, subordinated, economically marginal population), one cannot realistically imagine that this "equipment-dependent" solution is workable.

The students are grade-conscious. Thus, one says she likes school ". . . as long as I get A's and B's." Getting lower grades, "C's," means she has to work harder. She and children in other interviews indicated that a drop in grades results in punishing reactions from parents: loss of T.V. privileges, scheduled homework sessions, and moratoria on telephone calls. There were allusions to physical punishment, but no actual incidents were described. The teachers' consternation over "grade-oriented" materialism appears to overlook the connection between children's grade consciousness, and the degree to which grades carry the main burden of communication between schools and parents about their children's work performance. Most children regard school as work, except for a small minority who, like one ninth grader, had developed an urge just to "have knowledge," to be knowing and knowledgeable. Certainly work effort is measured in grades by the students; i.e., if their grades "drop," they must work harder to get them up to the A and B level. Moreover, in this system so heavily affected by legal restrictions on the exercise of other forms of social control (physical punishment, expulsion, etc.), grades are a main means of reward and punishment.

NSF INSTITUTES

The experience with an NSF-related Institute was less often encountered among social studies teachers than among math or physical-biological science teachers. It was much less often found among elementary school teachers than among junior or senior high teachers in the math or science areas. A young mathematics teacher was sorry NSF Institutes and other support had seemed to disappear (a common observation among those teachers who had experienced them). He valued the institutes not for their pedagogy, but for the conceptual understanding of the subject and the discipline they had offered. This teacher said the math he teaches now is more mathematically sophisticated than he would be able to teach had he done his degree work in education. A NSF-supported program allowed him to get a Master's in mathematics in a math department rather than in a department of education. He and other high school math teachers would have liked more institute experience in order to keep up to date on developments in mathematics.

There seems no doubt that for all science areas, for those teachers who had attended NSF Institutes, or off-shoots of them, the experience was an intellectual shot in the arm (or to the head) that they now sincerely miss. A junior high math teacher emphasized what she called "leadership." She claimed those who had attended NSF Institutes were heavily represented among those leading efforts to improve professional work conditions in the school, whether curriculum changes, teaching conditions, inservice training, organized teachers' efforts or whatever. Sorting out correlation and causation is a problem with such a claim. One social studies teacher who had never been "selected" to be invited to an institute suggested that teachers favored by "the administration" or some other decision maker were the ones who were chosen, not less favored teachers like herself. Thus, selection of participants who are "leaders" in the first place may be the explanation for the "leadership" phenomena. The institute experience, of course, might reinforce an already existing propensity.

RESOURCES

In the high school, the most salient innovative aspect of the math program was the presence of computer terminals for time-sharing with local city government's computer facilities. (The city furnished the schools with computer time.) The resources for transforming the computer terminals into a widely used, reliable, regular teaching-learning experience weren't yet available. The room itself was small, so that doing classroom work and terminal work in the same setting was a "noisy" affiar. There was no money to pay for assistants who would oversee the machines and individually help the students when Ms. Gregory was out of the room teaching other classes. Thus, she had to use students volunteers whom she herself had to train. But scheduling their available time on a dependable basis and getting them to the level of understanding at which they could independently help other students with their problems was not something Ms. Gregory had been able to bring off. Without this, Ms. Gregory said she simply couldn't leave the facility unsupervised for other classes to use at their pleasure. The hard reality was that if students did something inadvertently to one of the terminals, it would soon exhaust the budget available for repairs and parts. In addition, another major expense loomed, underlining the hazards of dependency upon another institution's resources. The city government was planning to change the program package used on the computer, thus involving enormous investment in man-hours to revise the schools teaching materials, etc.

The effects of marginal materials resources on projected plans and teaching activities was depressing. Although resources for high school biology were described as generally adequate, I heard from many teachers examples of six- to eight-month delays between the time materials were ordered and their arrival. A high school teacher spoke of putting in an order, and having all of it back-ordered repeatedly, a more distressing experience perhaps than knowing what you order this year won't come through until next year. There was an ever-so-tentative, but ever-so-frequent, suggestion that the way orders were handled at the board of education central supply office resulted in mixups, delays, and unfilled orders. Most teachers' emphasis was not so much on insufficient funding resources per se, but was on getting an order filled, any order. Teachers were often thrown back on their own resources; many furnished materials out of their own pocket. The science teachers had a continuing collection: bottles, scraps, and whatever might be used by students or teacher in classroom experiments or demonstration. One junior high teacher patiently and thoroughly washed out the gallon containers that ditto fluid came in, to use in the class demonstration of the classic "air exerts pressure" experiment.

The most reliable means of instruction was dependence on the spoken word of a teacher equipped with a ditto machine. Even a shortage of text books could be better controlled if one had a ditto machine, ditto fluid, and access to a thermofax machine. Cheap and simple to operate (most had hand operation features if the electrical system went out), they were quick, dependable resources. The marginal nature of the materials resources contributed to the ubiquity of copying chapters or sections from several texts and making them available to students for text-oriented school work. Even so, well-laid plans could be fouled by theft, if not by shortage or delay. Plans to give biology to some of the ninth-grade sections in one junior high, for example, were abandoned when all the supplies and equipment for the course, carefully collected in the late spring and locked in the storeroom, were stolen during the summer. Only a few specimens of embryos, that somehow didn't interest the thieves, were left. So the ninth-grade sections that would have had the experience, simply had an advanced section of general science.

In another instance, one section obtained Introductory Physical Science materials that the science teacher had learned about in an NSF Institute. To teach one of the classes about the balance beam, she set up a "project" involving the weighing of pennies, requiring that each penny be identified and weighed on several specifically identified balance beams. The students could not finish that day, so they left the beams and pennies set up and locked in the storage room. When they returned the next day, they found the pennies stolen and the beams out of order. The teacher recounted other such incidents and tried to explain to me the depth of her discouragement. I found myself beginning to question, "What resources of all sorts are required to carry on ordinary science education activities?" The material resources necessary to carry out science as projects, or to do classroom simulations of physical events so that scientific ideas and procedures could be presented and discussed, were chancey in this environment. The most reliable resource seemed to be textbooks and the ditto machine: a technology that seriously limited the classroom approximations of simulated scientific inquiry and knowledge development. Though books that used the written word and paper and pencil to simulate inquiry and discovery were well received by the children (the Pathways in Science series was a favorite with every child I talked to), the absence of equipment resulted in the traditional pattern of "assign, study, discuss, and test" pervading most of the classrooms I observed. Along with it was a special emphasis on word labels, definition of word labels and reading, that made the sciences as dependent on reading skill as were the humanities.

One aspect of the social ecological approach is the extent to which the human being in the situations is dependent upon the largess, or lack of it, of the social and material environment. What is it one may know or must know that reduces one's dependency on the conditions and resources controlled by others? This is particularly important when that control is capricious, from the point of view of the organizational level at which classroom teaching takes place. In situations of relative powerlessness and limited resources, what approaches will reduce dependency on others or will circumvent the arrangements that reinforce dependency? Both questions are essential to consider.

On my last school visit in an elementary school, the luxury of a half-moon open space area really impressed me, perhaps more after four weeks in more spartan and ancient surroundings. What I saw was a new, well-equipped, carpet-covered half-circle community room with a kitchen and visual media equipment "strip" separating one half of the room from the other. I didn't even get a chance to see its marvelous "media center" (that means written literature and visual aids, etc.). Fourth and fifth graders were engaged at three different positions in three distinctively different activities at one end, while in the other half a teacher lounged comfortably by a table, leaning back with an open book resting on her lap and flanked by a ring of thirty or so fifth-and sixth-grade children. There was a special privileged air about this school, with its lovely blue tile brick half way up the wall of classrooms. Yet there were elements of the same stress that beset the other schools I had visited. Thus, on our way to the open-space class, the assistant principal paused to admonish a little girl (seven or eight years) who was away from her classroom. "I don't see you playing in the hall, do I? No, I couldn't be seeing you play in the hall. Go on to your classroom now." So this school also had some of the problems of other schools.

MINORITY PROBLEMS AND SCIENCE

Probably because my study coincided with Black History Month, social studies I observed at all levels (except for one advanced placement class in economics) concentrated thematically on the history of the black population, the geography of the U.S., and the national and continental origins of the group. But without further evidence of visits at other times, I did not confirm this hunch. The emphasis on leaders, famous black scientists, and "getting it together" appeared on bulletin boards and in the teaching discourse at some time or other in every elementary and junior high school room I entered, and in some, but not all, of the high school rooms. There is a distinct message to all students that getting it together and doing well is not just a matter of individual choice and circumstance, but inevitably has implications for the ethnic group. This sense probably could not have been emphasized to such a degree in a more ethnically heterogeneous student or teacher population, whether mixed with some other ethnic minority, or in a 50-50 mix with white European-origin ethnic student and faculty population.

It is to be seriously considered, then, that the ever-present emphasis on reading, vocabulary, and articulateness is tied in some way with this sense of group mission. A minority group such as this one may pay a political price for being blase' about "proper" labels and articulate delivery of established ideas on a topic. The politics of access to opportunities was of fundamental importance to the teachers of these children, and was a key ideological message they incorporated into their teaching discourse. From the students' point of view, conduct and intellectual ability are thoroughly intertwined. My own observations, partly from interviews with students, led me to the claim that rowdy, disrespectful, disruptive conduct is attributed to low "mentality." By implication, if not in explicit word, such conduct is linked to the notion that these children have to acquire the intelligence to recognize their political position in the society. They must . . ."Get it together before it's too late" (final line from a grand finale song in the high school assembly program celebrating Black History Month).

Math and science have their place in these efforts. Scientists who were black were identified as significant career models for the children at all levels. This was significant because of the question of what students would do with their future. Concern about students' future extended to coping with technology, as well. Thus, computers were now part of every student's everyday life. Yet with only eight terminals and the lack of motivation, how could a methematics program be developed to allow the vast majority of students some experience with computers? This probelm worred Ms. Gregory but she had no hopeful proposal to meet the challenge, only a knowledge that something should be done.

This ethnic group, which predominates in the city population, still lives under a persistent barrage of social denigration from other sectors of the society. Consequently, the system suffers acutely the dilemma of elitism and equalization. Elitism, denigration, and exploitation do not cease at the membership boundary of an ethnic group, even an ethnic group that has coalesced on a ideology of its own brotherhood, beauty, and worthiness. If the group members have to exist in a world of competition for socioeconomic advantage, then egalitarian measures that "average down" the potential for the exceptionally talented may threaten as much as signal relief. They see the rules changing just as they've been admitted to the game. The personal reputation, identity and destiny of each individual in an ethnic population living under those conditions is closely tied up with the reputation, social identity, and destiny of the group vis-a-vis the society at large. Contrarily, no person identified by others as a member of this population can easily escape the extension of the group's identity and destiny to himself or herself. There is anxiety among teachers (and parents, too) that social and political battles are being lost. Some may view the teachers' growing opposition to mainstreaming and random mixing of all children, whatever their mental performance and behavioral conduct, as a self-interested, middle class, elitist rationalization on the part of a subgroup that "has it made."

But that would be a limited understanding of the special characteristics of the system. For it also should be borne in mind that the school system--not the economic system of private business and labor nor the political system--is carrying almost the entire burden of instituting equality of means to uplift a disadvantaged population. The agony that I often saw in the day-to-day life of school persuaded me that school system cannot bear this burden alone among the institutional systems of any city, or any society. That excellence in science teaching and learning happens at all is gratifying, given the exceptional poltical and legal conditions and the economic agonies to which this sytem is now exposed.

EPILOGUE

Beyond the school, the home, and peerdom, and out of the amorphous notion of community, the courts have emerged as a key power influencing school curricula. To protect individuals from the injustices arising from greed and prejudice and perpetuated by bureaucracies, courts are directing activities of the school. As operations are reorganized and resources reallocated to accommodate court requirements, the curriculum is bent to fit the new circumstances. Teachers and parents in Archipolis were aligned with one another, blaming "other" parents and the peers of their children for the schools' problems. Young people blamed teachers and "other kids." And I had a sense that there was an invisible "fourth force" exerting influence on the situation, checking the exercise of traditional authority by adults over children. The teachers' petition named the courts, but the personal exercise of the courts' authority was vested in agencies. Thus, public service agencies might well be viewed as wedged between the traditional authority of teachers and parents with respect to the public actions of young people. From this came the air of puzzled ennui that marked the outlook of many teachers. Although the courts are honored in a city peopled mainly by blacks, the teachers' petition to the union to initiate court action was a sign they had come to terms with the reality that courts, in the name of principles of justice, also can instigate havoc and hardship. The teachers have sensed that the path of counteraction is legal action, and they are moving to get that counteraction into motion.

There is evidence in this account that NSF Institutes have had a positive influence on teachers and the conceptual sophistication of their teaching. The teachers have missed the Institutes and the support they lend to strengthening the quality of technical and scientific understanding in teachers. It is notable, however, that the most obvious examples of scientific sophistication in social studies were not from NSF-trained teachers, but from teachers of social studies involved in a local effort. Curiously, while teachers and students live in an ambiance of the stuff on which the social and psychological sciences work and thrive, there is less evidence of NSF influence there than in any of the other several sciences. Support for social science seems to have come from agencies of social service and of the humanities and arts. So the social science activities that occur are mainly oriented to service and artistic perspective, and, in general, show much less scientific sophistication than other school sciences.

Clearly, science in schools is significantly and critically affected by the social context in which it occurs. Much might have been learned from a greater emphasis on conceptual content and materials of the science teacher. Nevertheless, discovery of what is or isn't taking place in school science, and understanding how it is that good school science cannot happen easily in many urban school settings, cannot be readily accomplished from that point of departure. Staying exclusively with questions of curriculum content and subject matter competence is a way to avoid the messy reality that school science really is. Probably no federal agency would willingly take on such a mess, least probably an agency of science. Still the question comes. Who will? Who will?

The school itself is a politically and economically weak institution. There is evidence of that weakness in the relationship of this school system to the courts. Its vulnerability as a taxing body cannot be described here. But the schools' constituency is predominantly a political minority. And the poor economic condition of the majority of the population served by the city public schools excludes the possibility of significant support or supplementation from some private sector. This is clearly a setting for posing the great puzzle of how elite science training can be brought to fruition for and among a politically and economically subordinated population.

REFERENCE

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JACQUETTA HILL-BURNETT

Jacquetta Hill-Burnett is Professor of Intercultural Education in the Department of Educational Psychology and Anthropologist with the Bureau of Educational Research at University of Illinois. She contributes to the CSSE project her talents as an anthropologist, having received her Ph.D. in Anthropology and Education from Columbia University in 1964.

Jackie is affiliated with and has participated in numerous professional societies in anthropology and in education. She has done ethnographic field research in Puerto Rico, the urban United States (with Spanish-speaking populations), and rural United States (with midwest Euro-Americans and with Mexican-American migrant populations), and in Australia with urban Aborigines. Her research interests include ethnicity, intercultural adaptation, culture acquisition, socialization/enculturation, and complex organizations for education, welfare, and occupations. She has been an active committee member in the Society for Applied Anthropology and is past president of the Council on Anthropology and Education. She has served as a consultant, at various times, to UNESCO, Kansas State University, the Peace Corps, ABT Associates, USOE, NIE, and NSF.

Her articles have been published in both anthropological and educational journals, and she has served as editor of News-Notes on Latin American and Carribbean Education (a periodical for social scientists interested in Latin American Education). Among her works in progress are several articles on her research in Australia, a non-fiction novel to report back to the barrio population her Chicago Study of Puerto Ricans, and a textbook on the anthropology of education.

Chapter 10

VORTEX AS HARBINGER

Gordon Hoke
University of Illinois

May 1977

10

The trials and tribulations of northeastern United States have not passed by Vortex. This older city of ethnic neighborhoods has witnessed a fifty percent drop in its public school enrollments and a catastrophic decline in economic fortunes. Coal mining characterized its early days; now Vortex is clinging to a handful of industries and its place as the hub of a ground transportation network.

Pennsylvania has a reputation for volatile exchanges in the domain of collective bargaining: again, Vortex is no exception. The state educational agency is known for placing regulatory demands on local districts and for its implementation of intermediate districts beginning in 1963. All of these elements are captured in the following portrayal.

We particularly sought the cooperation of Vortex residents and schools because of their purported relationships with the intermediate unit. Our study confirmed this situation. In addition, we were struck by the presence of a trio of other factors: (1) an outstanding middle school (grades 6-8) based on an "open space" concept; (2) widespread utilization of instructional media in the elementary grades; (3) a growing sense of dependency, by both community and educational institutions, upon the federal government.

Circumstances unique to the Vortex setting offered an opportunity for conducting a comprehensive site visit. The pair of site study reports accompanying the case study highlight items one and two; closing pages of the study serve as a backdrop for anticipating future expansion of state and federal policies in the operation of local schools.

VORTEX AS HARBINGER

Gordon Hoke

FIRST IMPRESSIONS

"It's the center of ethnicity," declared a young businessman who boarded my Allegheny flight in Pittsburgh. "Sometimes your departure from the plane is delayed because fifty or so relatives and friends may be on hand to greet an arrival--and you know how they care for one another." At noon the following day, a school supervisor and native of the city added to his remarks. I had commented on the beautiful, old-world architecture, and she replied:

> *Yes, it's a reflection of our great mixture of peoples. We have few blacks and Hispanos, and most of those who are here arrived many years ago; but the city was settled by Italians, Welsh, Irish, Polish, and Slavic immigrants. The Julian calendar, for example, is still observed by numerous families in the area.*

Later, the high school principal said: "If you're looking for a place to study problems, you've come to the right one because we have all of them." He was referring to a prolonged teachers' strike a year past, to continuing fiscal difficulties, and to a recent court decision upholding an arbitrator's decision that department heads should be reinstated in secondary schools. During the approximately thirty-six hours of my initial visit, a veritable litany of issues was confronting school officials. Assistant principals in the high schools and junior highs were rearranging pupil and teacher schedules in order to accommodate the court decree. Supervisors and coordinators were implementing cutbacks in curriculum offerings in response to budget slashes. Meanwhile, students were staging protests, signing petitions, and generally opposing those same reductions. The day before, the city library had announced curtailment of services because the board of school directors had refused to increase its financial subsidy to this civic institution, and the board also had become embroiled in conflict with a local public employees' union as a result of the former's decision to hire a private firm to collect taxes rather than continue reliance on a municipal authority. Such activity appears to be indigenous to the community, because it is described by a local newspaper as "a highly politicized town with a history of wrangling and ethnic divisions." Descriptions of activities related to primary elections and "Letters to the Editor" lent additional cooroboration to this assessment.

Given the set of circumstances outlined above, "Vortex" appeared to be an appropriate pseudonym: "a state of affairs characterized by rapidity of change, constant excitement, sometimes a rapid round of activity."

THE SETTING

Last year, Vortex hosted a Bicentennial meeting of Superintendents of Schools from cities of 100,000-300,000 population; and it is a member of the state's organization of

Urban Pennsylvania Superintendents (UPS), representing the eighteen largest cities in the Commonwealth. A comment appearing in a position paper drafted by this coalition in October 1976 is particularly germane to an appreciation of the past, present, and perhaps future of Vortex and its counterparts.

> *Good schools, we suggest, will aid in attracting those vibrant middle-class people with assets, both human and fiscal, back to the cities which continue for the time being as centers of housing developments, health services, culture, banking, commerce, and transportation.*

Despite its membership in an association of urban districts, transactions in Vortex are influenced more by the draw of suburbia than by an influx of colored minorities. The demographic pattern is summarized in Table 1.

Table 1

Student Enrollment--1976-77[1]

American Indian	8
Asian	28
Black	246
Hispanic	24
White	13,300
Total	13,606

But the old buildings, which appear so stalwart and impressive to an observer from the austere flatlands of Illinois, symbolize the problems. High ceilings, lack of insulation, and large windows through which winter winds whistle their expensive sound are integral parts of the administration building. Some "overflow" classes from the nearby high school are held inside. A tiny elevator operated by a friendly woman takes visitors to the third floor offices of the superintendent and his staff. Harassed by calls for cost-effectiveness, troubled by both energy shortages and expenses, caught up in a stormy sea of collective bargaining and legal mandates, administrative personnel are afflicted by the same conditions as their physical plant: they are valiantly trying to cope with circumstances which sorely test the limits of their ability and endurance.

The effects of age on Vortex schools and other community institutions are compounded by the uniqueness of the surrounding terrain. Downtown Vortex is literally "central city" located at the bottom of a valley. Travel in every direction from the business district to various sectors of the school district leads one up the hill. Students and teachers make frequent references to the "valley," its attractions for them and past generations of their families. Combined with the dominant influence of local colleges and a Jesuit university, this emotional pull helps create an insular effect. There is a universal, often humorous, recognition of this situation, but it also adds an exponential variable to the ups and downs of the social-political-economic climate. Whether or not the faltering economy can sustain future generations of local residents is an issue of grave concern.

The administration building, high school, and public library form a right angle as depicted in Figure 1. A few hundred yards north of the high school is another of the city's trio of senior highs. Years ago, when only two existed, this pair represented very specialized versions of college-prep and vocational schooling. Today, there is a more diversified student body in each site and the district is a member of the area (regional) vo-tech program.

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[1] These figures are for public schools only. Three secondary and fifteen elementary parochial schools, predominantly Catholic, enroll approximately 3400 pupils. Student populations peaked in the early 1930s when the public schools were accommodating about 25,000.

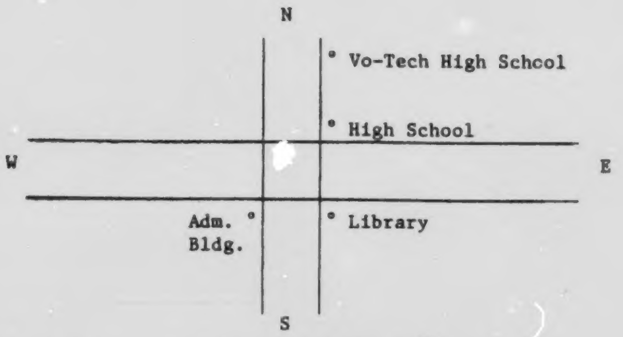

Figure 1. Key Locations - Downtown "Central City"

A few blocks south of this cluster are the downtown business district, municipal offices and the county courthouse. In close proximity are the county's junior college, the university, and the headquarters of an Educational Intermediate Unit. The state is divided into several (twenty-nine) regions each served by one of these agencies. Vortex was the only one of our eleven sites to maintain a working relationship with this type of resource base. Members of the "IU," as they are known in Pennsylvania, were extremely generous, and we spent several hours together. They work with school districts in three counties, offering programs and support services for teachers, administrators, and students. One of our junior high social science respondents is a member of the IU's Council on In-Service Training; its counterpart deals with program development. Her attempts to broaden the base of civic understanding were formalized by the process described below.

> *The Pennsylvania Department of Education has approved an in-service course entitled "Pennsylvania Local and State Government - 1976" to be offered by [the IU] for in-service credit only. The University has also approved the awarding of three graduate credits for the payment of a fee of $40.00 per credit.*
>
> *The course is open to all elementary and secondary teachers in the Vortex School District. Mrs. X, a teacher of social studies at East Vortex High School, has devised and will conduct the course. Those wishing to attend should register with their building principal by March 5, 1976.*

The excerpt above was part of a form letter sent to all members of the teachers' union; a briefer message appeared in a memorandum released by the superintendent's office. Earlier, the teacher had submitted an "application for State Approval of In-Service Credit" to the IU, which in turn channeled it to the State Department of Education. Teachers and IU staff alike are justifiably proud of their record in winning approval of such offerings.

WORKING GUIDELINES

In the CSSE Statement of Scope and Purpose, we had guaranteed anonymity to the sites, leaving the decision to publicize involvement in their hands. Two of the systems with which I worked chose to make an early announcement.

On January 24, 1977, the Vortex Board of School Directors formally approved a resolution concerning participation in the study. A statement also was given to the news media, February 10. It read:

> *The case studies are intended to provide background information regarding programs, procedures and problems as seen by teachers, administrators and students in order to show a national story of education in [three] vital areas. The purpose is to understand rather than compare.*
>
> *We consider it a distinctive honor to be part of the National Science Foundation project and I [the superintendent] am sure that our district personnel and community representatives will respond in a spirit of real cooperation.*[2]

During the four weeks on site, I worked in one high school (see above), three junior highs, and three elementary settings. Figure 2 portrays this arrangement; fiscal data is found on the next page, Figure 3.

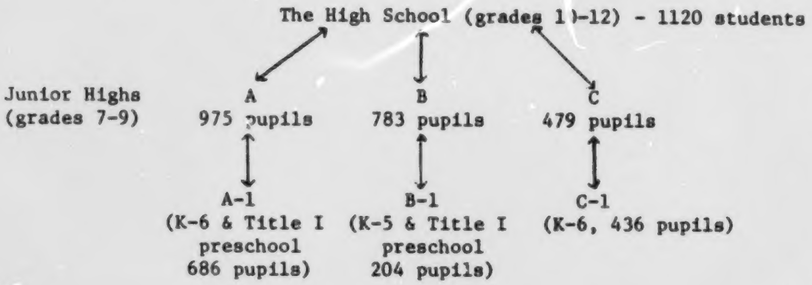
The High School (grades 10-12) - 1120 students
Junior Highs (grades 7-9)
A 975 pupils
B 783 pupils
C 479 pupils
A-1 (K-6 & Title I preschool 686 pupils)
B-1 (K-5 & Title I preschool 204 pupils)
C-1 (K-6, 436 pupils)

Figure 2. Study Sites[3]

I concentrated on three sources of information during this period:

1. Interviews with instructional supervisors and subject-matter coordinators, teachers of social studies and social sciences, relying heavily on a trio of questions viewed as central to our efforts.
2. Numerous classroom observations in both elementary and secondary schools.
3. Discussions with certain board directors and members of the curriculum and instruction division of the Educational Intermediate Unit.

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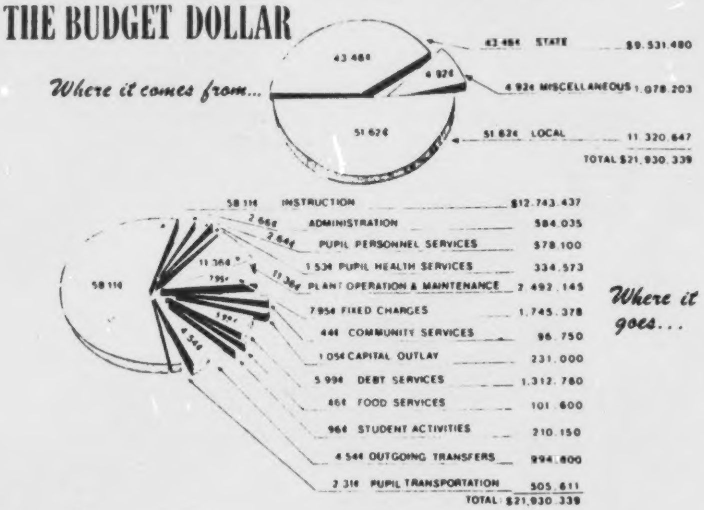
[2] All were extremely generous.

[3] In addition, the site study team spent several hours with teachers, administrators, and pupils in the Middle School, grades 6-8, enrollment of 995.

Figure 3. Vortex Schools Budget - Fiscal Year 1975

V-O-R-T-E-X SCHOOLS BUDGET — FISCAL YEAR 1975



WHERE THE MONEY COMES FROM

43.46% — **STATE** The bulk of the Non-District Revenue comes from the Commonwealth of Pennsylvania (State sources). This income is received through appropriations and special reimbursements granted to almost every school district in the State.

4.92% — **MISCELLANEOUS** Included in this description are the District's Opening Cash Balance (1-1-75), Federal Source Revenues, Incoming Transfers and Receipts Contra to Expenditures.

51.62% — **LOCAL** Tax Revenue constitutes the bulk of this local source money. Various forms of Tuition, Interest Income from Temporary Deposits, Rental Income and other Miscellaneous Income complete the Local Source Revenue.

WHERE DOES THE MONEY GO?

INSTRUCTION: 58.11%, the largest expenditure category of the 1975 Budget, calls for approximately $12.7 million dollars expended for Pupil Instruction. Included in this item are expenses such as Salaries for Professional Employees, Non-Certified Supporting Personnel, Textbooks, Teaching Supplies, Library Books, and Audio Visual Supplies.

ADMINISTRATION: 2.66% of the 1975 Budget is provided for Administration Expenses of the School District. Included in the category of Administration are expenses for operation of offices of the District Superintendent and his assistant, the Secretary-Business Manager and his assistant,

PUPIL PERSONNEL SERVICES: 2.64% represents services included under the Pupil Personnel category of the 1975 Budget. Expenses for Pupil Guidance and Psychological Services, Attendance Officers and Pupil Accounting Office are included in this item.

HEALTH SERVICES: 1.53% of the Budget is to be expended for Pupil Health Services. Included in this item are expenses for Pupil Medical and Dental Examinations, operation of the District's Dental Clinic, Salaries for School Nurses, and Salaries for the Medical and Dental Staff.

OPERATION AND MAINTENANCE OF PLANT: This item, representing 11.36% of the Budget, includes salaries of Director, Custodial and Maintenance Staff, Replacement of Instructional and Non-instructional Equipment, Contracted Maintenance, Fuel, Utilities and Sunday Supplies.

FIXED CHARGES: This category refers to payments by the District of its share toward Employees', Retirement and Social Security Funds, as well as the costs of Workmen's Compensation, Employees' Benefits, and insurance on the District's buildings. This item represents 7.95%.

COMMUNITY SERVICES: .44% of the 1975 Budget is earmarked for Community Services. This category provides for the District's share of cost for the Summer Recreation and School Crossing Guard Program; also contributions to the Public Library, Philharmonic Orchestra, Museum and the Child Guidance Center.

CAPITAL OUTLAY: Under this category expenditures are made for purchase of new instructional and non-instructional equipment for all School District facilities. This item represents 1.05% of the 1975 Budget.

DEBT SERVICES: This 5.99% of the District Budget provides for payments and Authority Rentals, and funds set aside to provide for the payment of principal and interest on outstanding bonds.

FOOD SERVICES: .46% While the Federal Lunch Program is now in operation through a contract with ARA, the District still must underwrite a variable amount of the expenses. These are placed in this category.

STUDENT ACTIVITIES: .96% This category encompasses a variety of activities for the students beyond the general academic curriculum, including cost of sports.

OUTGOING TRANSFERS: 4.54% This is a major non-cash category embracing the expenses incurred in services from N.E.I.U. #19, and the cost of educating the children at the Vocational Technical school, plus services for the handicapped.

PUPIL TRANSPORTATION SERVICES: Monies expended from this category must cover the day-to-day costs of transporting pupils in the District. 2.31% of the 1975 Budget will be expended for pupil transportation.

Although attempts were made to visit a large number of classrooms throughout the cluster of study sites, few recorded interviews were conducted with instructors other than those in social studies. Instead, I made arrangements for local teachers of mathematics and physical science to hold exchanges with members of our site study team. We had an opportunity to execute a comprehensive visitation in Vortex, and it seemed wise to capitalize on this good fortune.[*] Our intent, though, met opposition from the weather: we lost one day of the site study period to "the effects of one of the worst storms to strike [this] area in many years." It was a fitting climax, for Pennsylvania was one of the states hardest hit by the severe winter of 1976-77.

A pair of "mini-portrayals" are included in this report. They build on the foundation outlined above and feature the areas of secondary physics and remedial mathematics in the primary and elementary grades.

THREE PRINCIPAL QUESTIONS

"The total CSSE project has three principal questions to answer," wrote Bob Stake in October 1976. The trio included:

Question No. 1 - "What is the status of precollege science teaching and learning today?"

Question No. 2 - "What are the conceptualizations of science held by teachers and students?"

Question No. 3 - "What happenings in school and community are affecting the science curriculum?"

Responses offered by Vortex teachers, administrators, students, and parents should be interpreted against the background sketched below.

In December 1950, the superintendent prepared a document entitled Proposed Curriculum Changes and Revisions for the Board of School Directors. It stressed:

> *Science education which only a few years ago was largely optional and integrated in the lower grades has now become a major responsibility of the school. . . . Today, if the teacher is to meet her responsibility she must help the children, in ways appropriate to their maturity, to understand causal relationships and systematic approaches to the observation of phenomena. Moreover, even the young child must become more informed about the place of science and technology as major factors in modern life.*

A decade later, his successor--who served the district for almost thirty-five years as a teacher and administrator--wrote:

> *It has been frequently stated that the primary function of the schools is the cultivation of the mind, especially as regards the basic mental skills. . . .*

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[*] Two of our team members were mathematics professors at the local university. Both were natives of the area and well acquainted with its schools. In truth, they were part of the Vortex "family."

> *But it is equally apparent that this is not the sole function of the schools, for the community expects them to serve many other functions involving the vocational, civic, emotional development of young people.*
>
> *In our own friendly city it is often heard that we don't have much of a future. . . . If we are to meet the economic, cultural and social needs that Vortex confronts, the heart of its program must be a strong system of universal education. Every other effort at community improvement will be limited or facilitated by the understanding, the competence and convictions of the citizenry.*

Another superintendent entered the scene in the early 1970s, and he was presented with a report fashioned by a group of consultants. Its title read: Vortex: Schools at the Crossroads, A Long Range Development Program, 1969-78.[5] The planners declared: "Vortex schools are indeed Schools at the Crossroads, both physically and educationally." And a closing judgment by the board of directors' president asserted: "At this stage in the history of public education there is probably no public endeavor that is more important or more expensive than the education of our youth." His words served as a prelude to an October 1, 1976 news release. Presented in behalf of the Organization of Urban Pennsylvania Superintendents, it confessed that "statements of philosophy among the cities diverge widely; nonetheless, one fact is irrefutable. . . ." The report continued: "each participating school district and its municipality exhibit similar identifiable symptoms." Among those cited were the following.

> *Before they can be taught, many urban students require the services of social workers, welfare visitors, court officers, policemen, probation officers, and tribunals.*[6]
>
> *We believe that municipal governments, school districts, and counties are inextricably intertwined with public funds being the binding mastic. All three units are contributing to one another's bankruptcy. School districts and municipalities are creatures of the State, and when they fail, the counties and the State suffer, too.*

The high school was preparing for a Middle States Accreditation visit in December 1977. Hence, all facets of the curriculum were undergoing scrutiny and possible revision. At the same time, financial pressures were causing reductions in the number of course offerings, particularly social studies and English. "They've cut the heart out of our electives program," lamented Kurt Karens, chairman of the social studies department and building representative for the American Federation of Teachers. During a brief earlier visit in January, his district-wide supervisor had told of her efforts to preserve some semblance of "integrity" for the secondary program.

Class size has also increased, but the range of courses, at least on paper, is still impressive. It must remain that way if one of the general objectives for social studies, grades nine through twelve, is to be honored. The tenth and last objective states:

> *Acquiring knowledge and learning the basic concepts inherent in the social sciences; geography, history, economics, sociology, political science, anthropology; developing skills essential to these fields.*

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[5] All districts in Pennsylvania are required to file a similar plan with the state agency by 1978. Pennsylvania has a record of state involvement in local operations beginning with the School Reorganization Act of 1963 and the more recent "Ten Goals of Quality Education."

[6] The county probation officer told the city council of an "alarming" rate of broken families in the area surrounding Vortex.

The following remarks, one by a teacher and one by a student, reveal their perceptions of this range of offerings.

> *Unfortunately [Kurt rebutted], social science is too often seen as a synonym for a collection of courses--often lacking in sequential development--a course here and a course there--with the belief that by offering such courses, the student learns once and for all.*

> *[An outstanding senior responded:] I want to learn about people, about how we can live together more peacefully, that's why I'm taking courses in sociology and psychology. In history, you keep repeating what you've been taught before.*

The K-12 coordinator of social studies basically agreed. Referring to the emphasis on world and American "cultures" in the junior and senior highs, she indicated that the district was trying to implement a new curriculum in the lower grades. "It will mark a shift from history to social science," Maureen declared.

Pennsylvania's State Board of Education mandates much of the social studies curriculum. Six units (years) are required in grades seven through twelve, with the content of four units established by state regulations. Mathematics and physical science are granted more latitude, but Kurt's earlier observation is not seriously challenged in these domains.

Advanced placement classes are still available in chemistry, American and European history. Instructors, though, are greatly concerned about infringements on class time, about the need to accommodate contemporary affairs while preparing pupils for traditional demands of tests, and about changes in motivational patterns of youth. A session in advanced placement American history, eleventh graders, underscored the complexity of classroom transactions.

The topic was "assimilation." A Jewish student was presenting a report on the experiences of his people; parts of it touched on the policies of Adolph Hitler. As the paper concluded, a classmate referred to a "60 Minutes" episode the previous Sunday regarding the American Nazi Party. An interesting, dynamic period ensued, but was brought to a rather abrupt close by the instructor. Later, when we were discussing the series of events, she explained:

> *I literally don't know how to balance off current affairs with the need to cover material. They often introduce fine examples from televised programs, yet I know that the [advanced placement] exams are heavy on content coverage. We used to have several 4s and 5s [top scores]. Last year we didn't have any 5s, and several 3s were received.*

Interactions with students suggest that reasons for taking certain courses are changing--that is, math, science, and the social sciences are seen as tools for eventual careers or jobs in health and medical fields, in other realms of social service, as a means of understanding self and others, and not as a prelude to becoming a mathematician or scientist. The number of extra-curricular activities identified with social services is increasing and students are aware that for them the "services society" means jobs as well as higher taxes for their parents. A senior in chemistry noted: "We've started a medical/health careers club and have about fifty members. There's lots of interest." In response to a second question, he responded: "Because of prestige, money and jobs."

The coordinator of English and social studies was spending her last year in the city. Her contemporary in science had suffered a fatal heart attack midway through the school term. Their counterpart in mathematics was temporarily assigned the latter's duties and an internal assessment of science instruction and learning was begun during my stay in

Vortex. Similar efforts in mathematics had already been completed. Under his leadership the math curriculum had been revised on a K-12 basis; it features such components as Title I "Math Labs" in the elementary and junior high schools, a local adaptation of one of the modern math programs at the elementary level, and is climaxed by calculus and "computer statistics" in the senior high. Comprehensive efforts in metrics education are underway.

Physical science in the high school is based on the usual pattern of biology, chemistry, and physics, but with a notable exception: physics is seen as a course for juniors, chemistry for seniors. The rationale for this sequence is explained by the "mini-portrayal" below.

A Question of Maturity

"Yes, you normally find seniors taking physics," agreed James Romano, a youthful instructor of intermediate algebra and PSSC physics. "But then," he added:

> *I've talked it over with Joe McCauley, who's taught all the sciences at one time or another in this school, and he says the kids need that extra year of maturity for chem lab. Personally, I'm undecided, because Paul [his physics cohort] and I are concerned about the math requirements for physics.*

I had begun the day by attending Paul's lecture in physics. He and James alternate between PSSC and "regular" classes. When I inquired about student selection procedures, Paul indicated that sophomore science instructors were asked to recommend students for PSSC classes. He noted:

> *Actually, James and I are more concerned about math competency than their references from science classes, although we've never done any follow-up studies to see if math is as big a factor as we believe.*

Both Paul and James were using experimentations in their rooms. A film strip, presented and narrated by a student, was serving as an introduction to a unit on temperature and its effects on matter. Paul opened the period by wondering aloud: "Which would freeze first, hot or cold water?" No consensus was obtained, so small containers of heated and tap water were placed outside the window. A student was asked to chart changes in temperature on the board at five minute intervals. The film strip was not outstanding. Paul directed attention to a caption and said: "Now that's a terrible sentence! There has to be a better way of expressing that point." He asked for some illustrations and provided two of his own. When I complimented him at the close of the period for this action, Paul replied: "Every teacher's a teacher of reading and writing. Whether or not you want to be, you are."

PSSC students were examining principles of velocity and acceleration, relationships between motion and production of energy. James and a student began the double-session with a series of demonstrations followed by students pairing off and moving into the laboratory to conduct similar investigations. Several remained after the dismissal bell to complete their work, to make up tests, and to engage in friendly banter with the instructor. Paul and James are co-sponsors of the Physics Club; both men have an easy, informal relationship with students. As I left the physics lab, I spoke favorably of the warm, responsive atmosphere present in their classes throughout the day. James nodded in the direction of a handful of pupils and commented: "They make it worthwhile. I don't know how you can teach and not like to be with kids."

James and Paul are graduates of the local university, as are many of their colleagues at both secondary and elementary levels. Earlier in the week, a consultant on the IU staff cited problems elementary teachers were having with "inquiry methods" and the new K-6 social science curriculum "Our Working World." He attributed part of their difficulty to deficiencies in preservice education because "[that] school is heavy on subject matter but weak in the area of instructional methods and classroom demands." The district coordinator of social studies basically agreed. "Teachers are experiencing difficulty with the inquiry approach," Maureen said, "and we simply don't realize what it means when we suggest to an instructor that she needs to change her classroom practices."

David Hamilton's suggestion (in CSSE Statement No. 8) that "integrated curricula may be worthy of special attention by CSSE observers" is pertinent to an understanding of science education in Vortex. Enrollments in physics and chemistry are declining; science instruction is "on the back burner in elementary grades," warned the supervisor of preschool-6 operations. In the junior highs, a cadre of instructors is trying to combine social and physical sciences in the name of "Earth and space science." Transactions in the name of environmental education may not yet be grand versions of "integrated curricula"--in my judgment much work remains to be done with respect to using methodology capable of linking student knowledge of and interest in contemporary events to factual content--but they appear to be an important step in that direction.

The supervisor of secondary education for Vortex is obviously proud of the developments related to environmental education. Aided and abetted by the Intermediate Unit, two instructors from the high school's nearby cohort are participating in a pilot project. Their emphasis is on social activism, student involvement in neighborhood or community studies of pollution's effects, etc. Their contemporaries at the high school are relying on a more subject-centered approach. Two young women operate as a team: one holds an M.A. in history-social science; her partner is working for a master's degree in biology. The course (elective for juniors and seniors) is divided into quarter-terms with students alternating between instructors on a quarterly basis. A year ago, the biology teacher taught the course alone. "I couldn't handle the interdisciplinary demands," she said. "Very quickly you're into economics, or law, or politics; even today, when we have a unit on solar energy the students try to carry discussion of issues into physics or chemistry classes."

Other developments were summarized by a junior high principal whose career has been identified with science education. As a high school instructor, according to the associate superintendent, "he was a good teacher and a tough one, but the kids liked his classes." The principal is still active as an instructor in a small Jewish prep school.

> *Teachers are very uncomfortable with science [he asserted]. You really can't blame them. Personally, I think instruction in science should be left to the upper grades. About all you can ask for is solid preparation in reading, especially comprehension, and mathematics when they reach you in the junior high.*
>
> *I'm not happy with what's been happening in recent years. We now have life science for one semester at the seventh grade; physical science is offered at the eighth grade. Have you seen that book? Boy, it's tough, particularly in the math requirements.*[7] *Earth and space science is the ninth-grade course. Rarely is it completed--lots of sophisticated topics--and the district has invested considerable money in texts and related materials. The state pushed it; most teachers aren't prepared for it.*

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[7] An opinion shared by staff in all three junior highs.

> *Actually, we've lost in the process. Mathematics is dominating the junior high science curriculum so fewer students choose it at the upper levels because they're "turned off." The eighth grade course is so demanding and has replaced general science as a stepping stone to high school. The latter was much better because it was a good introduction to biology, physics, and chemistry.*

His admonitions about computational demands were reflected in the presence of Title I math labs. Two function solely for primary-elementary pupils; the other pair are located in two of the junior highs. The mini-portrayal describes operations in one of the K-6 grade schools.

A Matter of Choice

"We are barely into our second year with the Title I Math Lab at this school," the principal noted.

> *This was a K-8 school, but was changed four years ago, mainly because of declining enrollments in the area. The new pattern has left us with a K-6 building and a different student population. Before the change we had mainly the sons and daughters of professionals, college professors, and the like. Now we have few of the "high" and many "lows," with few from the "middle." And for the first time we have several colored children.*
>
> *I'm pleased with the Math Lab and with the services received from the company we're dealing with. In fact, I'm hoping that a Reading Lab can be started next year at X School, in order that we can exchange students with special needs. There's lots of paperwork associated with these special programs and we have specialists coming in virtually every day, including one who works with five Indian children trying to learn English as a second language.*
>
> *Students in the Math Lab are drawn from those who score a grade level below their current placement as determined by scores on the Stanford Achievement Tests; the program begins at the second grade. We used to have remedial summer school, Saturday morning classes, after school sessions, and other ways of handling deficiencies, but no one wants to be seen as a "dummy." The Math Labs have been much better from that standpoint. We try not to schedule the students out of another course, such as reading, where special efforts also are underway. We don't make them go to the Lab, but very few refuse. Occasionally, I'll have a child say to me: "I don't want to go to Math Lab anymore." And I tell him: "Okay. But you can't make that choice by yourself, your dad or mother will have to ask me, too."*

I then moved to the rather cramped Lab where Joseph and his young aide were working. "Yes, it's a form of prescriptive learning," Joseph confirmed. "Tests are scored and diagnosed; prescriptions reported back by the company (based in Chicago)." Joseph paid high tribute to this organization, citing its fine inservice training, the consistent maintenance of equipment, the quality of consultative assistance, and the computer-based testing-prescriptive printouts as all outstanding. It was unusual, albeit low-keyed, praise for "back-up" services.

I raised a specific question concerning the level of test diagnosis, referring to a study conducted by one of our research assistants who concluded that gross difficulties, which teachers already grasped, were the main product of test utilization, with instructors receiving little aid in pinpointing a pupil's idiosyncratic needs. Again, Joseph remained steadfast in his praise of the test materials. His testimony was important because it reflected a dozen years of mathematics instruction in elementary schools plus seven as an instructor in the Vortex Basic Skills Program. Joseph then explained:

> *We work around their schedules as much as possible. Don't want to create "hostile" kids because those who come in here have a history of failure; after all, that's how they get here. The Lab is not "instead of" but is "in addition to." Our focus is strictly on the individual and his need for skills improvement. The "Company" has urged us to do more small group work at the table here, but I'm opposed. We do combine episodes with the hardware with pen and paper reinforcement drills, but our main purpose is to make this period as different as possible from normal classrooms.*

A group of fourth graders began to enter the room. I watched them work with the wide array of both "hard" and "soft" learning aids, recalling a K-1 classroom of several years ago at the University of Hawaii's Laboratory School where I first saw children functioning extremely well with technology. Students there paired off and assisted one another, as a few did in the Vortex setting. But the effects of Joseph's operational philosophy were apparent: students were working mainly on an individualistic basis. A few were counting on their fingers, and I asked Joseph: "If you had the space, would you want an abacus here?" "Definitely," he replied; "There's a difference in 'hands-on' approaches, and you can see the need for more manipulative experiences."

A girl displayed very low levels of frustration tolerance, and I commented to Tory, the aide. "Yes, she doesn't have much patience," Tory acknowledged, "and the older they get, the more you see that kind of behavior. That's why I dread going to School X to pick up their sixth graders." I made that trip with Tory, and the reasons for her uneasiness were clearly evident. The same activity raised other questions that must be faced in the development of special programs.

We drove about six blocks to X where Tory parked her car. The pupils were on the verge of having a "milk break" and some were angered by the interruption. Their teacher promised they could have the milk when they returned. The bus then transported us back to the Lab where students were to spend approximately thirty-five minutes. "Some days the buses aren't on schedule and we lose a few minutes," Tory said.

Once in the Lab, students rather quickly--surprisingly fast, in my estimation--began working. A few words or gentle shoulder taps from Joseph calmed two or three boys and Tory explained to a girl: "If you don't watch what you're doing, the recording won't stay in time with the problems." It was a productive session; almost all pupils finished tasks assigned by their individual folders and were checked-off by Tory or Joseph. We reassembled for the return bus, a different one arriving from yet another corner of the district.

Getting students ready to learn is a crucial matter, particularly those who have a history of learning "failures." Joseph and Tory performed nobly given the constraints of time, space, and scheduling. Their efforts underscored the importance of people who link children to the technology. The role of instructional personnel who function at that point where learners interface with machine appears certain to grow in significance. My own children have had negative experiences in similar circumstances, and it was a pleasure to watch the scene described above. But the "paperwork" often associated with such efforts remains a formidable consideration, and Joseph and I discussed the need for computer-managed systems. The task of blending lab activities with classroom routines also must be faced. Joseph's caution that the Lab experience is strictly "in addition to" does not eliminate the classroom teacher's resistance to interruptions nor does it negate the pupil's need for some type of synthesis.

At the moment, media-oriented programs, such as the Math Lab, stand out as isolated enclaves, analogous to the Language Labs spawned by NDEA legislation of the 1950s, a promising and undeveloped aspect of public schooling not yet integrated into a new conceptual and operational mode of education.

VORTEX AS HARBINGER

"Have you thought about the possibility of not getting valid responses?" asked Kurt. He was alluding to the potential effects of a series of retrenchments in programs and staff ordered by the board of school directors. Later, we discussed the ramifications of his query, both of us admittedly seeking the proverbial "light at the end of the tunnel." Kurt was more pessimistic, perhaps grimly realistic, about the future of public schools, contending that both urban and rural school districts alike are faced with severe financial constraints.

> *[He remarked:] It seems inevitable that new alternatives must be developed to adequately fund public education. All interested parties will have to join in finding new approaches to this problem. However, all parties should also beware of the dangers inherent in making staff reductions and program curtailments the first items to be cut in retrenchment endeavors. Such policies are ultimately self-defeating and work to the detriment of the total enterprise.*

Later, his concerns were echoed by a building principal who insisted:

> *What you're seeing here is the destruction of the neighborhood school concept by economic problems. These old buildings simply can't be justified anymore.*

Yet my experience in Vortex, despite its outwardly forbidding veneer, left me with a belief that a new era of American schooling is underway. The signs were evident, in my opinion, although their interpretation and significance are open to dispute.

First, the high school was functioning well. Student morale was high; teachers and pupils dressed smartly, acted responsibly, and held mutual respect for one another. Administrative-staff-student relationships contributed to a healthy condition. Relationships with the Catholic system also were good. Catholic Youth Center facilities were used as a home site for the high school's basketball games as well as many other extra-curricular activities sponsored by the district. In general, there was a high level of cooperation between parochial and public schools in Vortex.

Second, Vortex instructors struck me as being living embodiments of Ron Corwin's (1965) "militant professionals." Kurt, Paul and James and a junior high advocate of the feminist movement stood out, but they were not the only ones. Today's highly-organized teachers, marked by their adherence to comprehensive bargaining agreements and demands for participation in decision-making, may not fulfill the traditional roles many administrators and parents hold for them. Nonetheless, they were working--and working very hard. As Kurt declared: "At the bottom line, it's the classroom where it all counts."

Events in this setting suggest the need for observers to distinguish between militant teachers willing to strike--but lacking sophistication with respect to bargaining techniques, a factor evident in another CSSE site--and seasoned instructors who can cope with classroom demands while engaged in negotiations. A member of the IU staff, for example, regards the president of the AFT local in Vortex as an "authentic professional unionist."

And Kurt, who is vice-president, teaches "collective bargaining" at Penn State University's extension center. But the scene in Pennsylvania may be altered. Act 195, the state's public employee bargaining law, which guarantees state and local employees the right to strike and teachers the right to unionize, is being reviewed by a special commission appointed by the governor. This particular bit of legislation is regarded as one of the most liberal statutes of its type; and since its inception in 1970, Pennsylvania has witnessed a record 361 teacher strikes.

When I commented to a board member about the task orientation of instructors, she remarked: "That's interesting, because a few weeks ago I was sharply critical of them for putting in so few clock-hours of instruction." It is true, as she notes, that bargaining agreements have sharply delineated the central elements of a teacher's job. For example, Paul and James reacted to my initial overture with considerable reserve and skepticism. The unspoken query was "Why should we help you with your study?" Two important qualifications must be raised, though. One is the obvious fact that good teaching is a tough, demanding job. It always has been, and in the eyes of this observer--who has been a high school instructor--it is getting tougher. The assistant principal of the high school supplied the second demurral. "Teachers will work very hard," he submitted, "*if* it means something to them." He was alluding to their participation on committees preparing documents for the upcoming accreditation visits. "Both of us [school administrators and teaching staff] fought to prevent the recent cutbacks," Jack continued. "We lost, but were united in a common cause." He professes great respect for Kurt in the latter's role as AFT representative, calling him a "reasonable, intelligent man." Overall, though, it appeared that AFT's strength was concentrated in the secondary schools. There was more evidence of NEA-PSEA literature in the elementary buildings and there was less adherence to work rules.

A third factor is embodied in an ambitious program of educational television. Vortex schools are tied to a PBS station approximately fifteen miles from the city. School buildings--and much of the city--are also wired for cable-TV. Students engage in production and performance activities beginning with the primary grades, frequently preparing video tapes for local use. ETV is part of the audio-visual department, and its director, who is an outspoken advocate of the medium, views instructional television as having a major influence on science education in the lower grades: "Science for the Seventies" and "Measure Metrics" are two of the products used. The director was once a physics teacher and admits that scheduling complications in secondary schools are seriously restricting utilization of ITV at that level. Continued dependence on conventional forms of delivery systems may become prohibitively expensive and/or face grave challenges with respect to access to energy. In Vortex, at least, the chief ingredients for an alternative system are on hand.

The aggregation of resources devoted to certain types of inservice training, as illustrated in the approach described on page five, reflects a fourth area of potential strength and also spotlights a question posed recently by Donald Schon. Analyzing the problems encountered in two decades of curriculum reform, he asks:

> *What would it be like to make implementation or adaptation central to the enterprise? How might a central institution take on the role of providing the framework, tools, means of assessment, and resources to local schools so that they can become more competent at adaptation or implementation and indeed at design?*

Perhaps the reliance on classroom instructors as a source of ideas, aided by a local university and teachers' union, and linked to the state agency via an intermediate unit, is a meaningful response to Schon's challenge.

Unquestionably, economic constraints are the chief influence in the current educational climate of Vortex. Their impact on social studies and English was cited earlier. A group of building principals furnished a succinct analysis of how monetary ills affect their jobs. "You no longer think of '3-20s' [three classrooms, twenty students per room] but of '2-30s.'"

Economic woes are not likely to ease because the governor's budget allows for no increase in the basic subsidy or school-aid formula. And spokesmen for the Pennsylvania State Education Association charge that current activities signal an attempt to force communities to absorb a larger share of educational costs. However, procedures and processes for delivering the curriculum struck me as more seriously affected by events than the curriculum itself: a major reorganization of schools is underway in Vortex.

Declining enrollments have caused the closing of six elementary schools in recent years and the conversion of one into a junior high. Meanwhile, a feasibility study relative to possible reorganization of the high school with its sister institution into one administrative unit is being conducted by a team of consultants. This action is part of the Long Range Plan and also mirrors both dwindling enrollments and the rising interest in job-related courses. The number of students choosing the vo-tech curriculum in this traditionally academic-oriented high school has quadrupled (40/160) in the last three years with the 1976-1977 sophomore class showing the greatest interest to date. And the Middle School, another component of the Long Range Plan, has already encountered staffing reductions which, according to its supporters, are threatening to "destroy the concept."

In summary, the economic crunch encompassing Vortex schools, the city, and much of northeastern United States is becoming so severe that it is literally forcing overdue recognition of structural changes in our society. From this standpoint, the ESEA legislation of 1965 may have been a forerunner of events to come. "Without federal funds," stressed the chief librarian, "we'd be in worse trouble."

> *Title I gave us a tremendous boost in the 1960s as it provided the wherewithal to develop our system of elementary libraries. A few years ago our budget was roughly $6 per child for materials (Vortex and all Pennsylvania schools furnish free texts); now it's about $2.25, and you know what's been happening to costs of books, magazines, etc! Title I, despite recent changes, and Title IV-b and -c are essential.*

The same point was made by the city's controller. Emphasizing that approximately fifty per cent of the general income fund was tied to federal programs, he said:

> *These figures clearly reflect the amount of dependency that municipalities such as Vortex have on federal programs.*
>
> *It is also clear that without such an influx of federal dollars, the already heavy tax burden of local residents would become intolerable.*

POSTSCRIPT

Our work in Vortex owes much to the associate superintendent, Jay Luttrell. He typifies a vanishing breed of "schoolmen," individuals who entered the field shortly after World War II and have remained pillars of stability throughout the trying years of growth and decline. Jay is nearing retirement. His influence will be missed in Vortex and in the larger world of public education.

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VORTEX SITE VISIT

The introduction to "Vortex" referred to a pair of site-visitor reports. In the first attachment, Jo Day examines relationships between elementary teachers, pupils, and administrators, reflecting on the lasting influence of traditional patterns of interaction. Both she and Beth Dawson treat the use of educational television in the lower grades, an area in which Vortex schools were doing some fine work. Dawson also provides readers with a comprehensive view of a middle school. Her tribute to the principal's leadership, to the latter's philosophy, and the description of how "open space" becomes a learning-teaching medium contrast markedly with the scene portrayed in RIVER ACRES.

SITE VISIT REPORT

Unlike other sites that are considered and consider themselves conservative, Vortex has not been noticeably touched or pushed to change via any state or federal legislation. Federal money is utilized for academic programs, but the predominent atmosphere remains clannish. Teaching, one of the better-paying jobs in this community of light industry, is a friendly male bastion. All elementary principals are males, even though most come from secondary teaching backgrounds.

The school is permeated with family and friendship ties. The discussions and greetings are not of the world of work, but of the workd of a family--argumentative and joking. One teacher is introduced as a mother-in-law, and a couple of children as god-children and nieces and nephews. In a walk down the halls of the newest elementary school or into corridor-like cloak rooms of the old (1884 to 1895) schools, the male principals reprimand women teachers; and these teachers argue (loudly) with them regarding the amount of punishment a group of children should receive, whether or not they have to open the folding doors between rooms, or whether or not their class should attend an event. The principal takes the more liberal view in every case.

Home-school ties are reinforced in the emphasis on developing "good habits." A couple of classrooms respond in unison, "Good morning, Mr. Kuhn," after the principal has said "Good morning, boys and girls" upon entering their classroom. The superintendent says, "Parents have a major role to play in helping to cultivate in their children a love for learning, a capacity for hard work, a sense of determination and perseverance, and a compulsion to respect and to serve others." He continues with recommendations about how to encourage children to develop regular habits. The patriotic and moral aspects handled in the schools include such things as opening exercises in elementary schools. Ten students from intermediate grades use video equipment to produce the following type of program daily:

The pledge to the flag
"My Country Tis of Thee"
A proverb: "The way we think determines how we live."
Announcements: "Continue to bring in your Campbell's Soup labels."

Parents as Advocates

Both in formal interviews and in informal conversations, parents reveal an opinion of the teacher as an educational expert. Parents do not articulate, nor are they interested in defining, what the school should do with academic programs. All programs are introduced by educators, and always with attention to funding arrangement. At no time is it possible for either educators or parents to separate program statements about rationale for selection from financial considerations.

Everyone - PTA and advisory council parents, teachers, and administrators - is very sophisticated when discussing where and how funds are obtained for a variety of programs and the materials utilized in them. The parents watch-dog PTA money by suggesting where an administrator may get materials on the list he has presented to them. They seem well aware of title monies and are pushing the board for a federal coordinator who can advance the cause of obtaining money.

Most programs - such as their planetarium, TV and video equipment, math labs, and textbooks - are described as coming from Title I funds, ninety percent reimbursement from state acts, Campbell's Soup labels, or free offers from commercial establishments such as the "Radio Shack." Not all schools have all of the above, however. These discrepancies between schools are what parents do notice and act on by pushing their principals to find and request programs that are funded in a variety of ways.

Title I Math Labs

The Title I math program is one of the few in Vortex in which children are engaged in individualized instruction and are individually utilizing electronic equipment. The children's ability to use the equipment is such that I had to ask them how they did it, because their movements were too quick for me to follow easily. Here, as in ALTE, the more individualized instruction and electronic equipment were used, the more teachers were available per student.

The principal and the Title I math teacher described the program as follows:

> *We start with second grade pupils here because it is difficult to get a kid working a year below level at first grade.*
>
> *The machines are what the Title I math program is about. Kids can do metric or manipulative equipment in the classroom.*
>
> *We do pre- and post-testing. Originally, we did the post-testing in September. Now it is done in June, and it then becomes the pre-test.*

Science in the Elementary Schools

All fourth-, fifth-, and sixth-grade children attend planetarium shows twice a year. In addition, next year, 1300 children out of 6000 will be serviced by two science specialists. For all other elementary school students, however, the state of science and the confusion in an "educational expert's" own mind about what science should be, can best be described in the following words of a principal.

They don't expect, at the elementary level, to cover an entire book. They would rather pull the units they are most comfortable with. But there is a danger here...where we can't have every teacher every year comfortable with the same unit. There has to be a flow. This is why I can envision a fella teaching everyone. Where that science book would be covered in its entirety as a child passes through the building.

Because right now, a woman in a third grade science book, what's she going to be comfortable with? With something on animals. She arranges a trip to the pet store, to the zoo; they bring in animals. That's a very comfortable situation. But she looks at electricity and it's ridiculous.

But if you have a person teaching science who really loves it, those kids really have a good science program. On the other hand, I've had to almost force someone to put the science kit in their classes. No one wanted to have anything to do with it. You know how science was treated? They got their minimum time allotments in. It's a frightening thing, but I don't think it's the most important thing an elementary school offers. I think it has a very definite function in the full curriculum.

We have equipment now, not a whole lot in these old buildings....but [for] anyone who has had an interest in doing something in science, it's been relatively easy going through the principal and the science people to get that equipment for them. Because, quite frankly, it's just not that popular. There are about 300 elementary teachers and not too many of them are knocking down the doors. We give them the invested amount every building has for every grade level. There are life-like diagrams of the anatomy, big hands-on, done-in-relief type things the kids can feel. These things are there, but if the teachers are comfortable with it, I don't know.

Miscellaneous Quotes

About a new "open plan" school:

He has the best of all worlds - an open school (physically) with traditional programs of graded, self-contained classes. And lots of specialists.

About elementary science:

Every year the elementary teachers cover the first chapter, "What is a scientist?"

From a high school math teacher with Master's degree in math:

The books are too hung up on theory. Kids don't distinguish between a line and the length the first time through geometry. They just want to get from A to B.... Grade schools are too much into theory also. Some of my third year math students can't divide right.... Even though theoretical math turns me on, most people never go into theory, or need to.... I used to be really fatigued at the end of the day. That happens until you get used to handling the kids. Some teachers never do get used to it.

Jo Day

VORTEX SITE VISIT REPORT

Two and one-half days were spent in a new middle school (grades six through eight). Activities included an extensive tour, interviews, and observation of classroom activities. Extended interviews were held with:

the principal;
a media specialist;
a mathematics teacher;
a science teacher;
a remedial math and reading teacher;
an astronomy teacher, who also operates the planetarium;
two professors of mathematics from the University of Vortex;
two representatives from the teachers' union;
four children.

Briefer interviews occurred with: the vice-principal, a mathematics teacher, a science teacher, two social science teachers, a counselor, and ten or twelve children.

Brief Description of the Middle School

In 1968-69, a long range development study culminated in a district-wide plan to move to a school system of kindergarten through grade 5, grades 6 through 8, and grades 9 through 12. The planning and construction of the middle school I visited was the first step in this plan. The school is estimated to have cost 6.2 million dollars and was commissioned to incorporate the educational needs that were two years in planning. This beautiful building includes a planetarium, three gymnasia (one large, one small, one for children with special physical problems), a swimming pool, a small theatre, and extensive music facilities. The theatre and swimming pool can be secured from the rest of the school and are available for use by the community.

The school is divided into three clusters or houses: each house contains approximately 320 students from all three grades, and classroom space for communication arts, mathematics, science, social sciences and a reading laboratory. Another section of the building contains classroom space for unified arts: art, sewing, cooking, typing, graphics and shop. The three houses and the unified arts area surround a learning resources center and the planetarium. (The reader is referred to the attached schematic representation of the school and its programs.)

One of my first impressions was the order and cleanliness of the school: the walls, floors, etc., are immaculate. This in a school that has been in operation over two years. It was only later, in talking with the teachers and especially the children, that I began to understand the joy and pride with which this school is viewed.

This school is like our home. Why would we want to destroy things?
We would only be hurting ourselves. (eighth-grade student)

Pride - or perhaps even more descriptive, an appreciation of the facilities and opportunities for learning in this school - was evidenced in almost every contact I had. This and another theme, that of providing the children with "hands on" experience (to be described later in this report) are the two overwhelming impressions I have of this school. These two themes seem to permeate and direct the activities of all concerned, teachers and students alike.

The principal of the middle school is a dynamic lady who was quite instrumental in the planning of the school. She chose the middle school concept in order to "give back to children a part of their childhood" by combining the security of the elementary school environment (through the use of the three school clusters) with the independence of high school (by allowing children to move freely from one class area to another and to select "elective activities" during three periods each week). The school embraces the open school concept, but in the words of the principal, in three important and integrated ways:

1. open curriculum with flexibility of planning;
2. open structure - the only "bells" are at opening and closing of school. Throughout the day, activities flow fluidly through fourteen time periods called "mods," each lasting twenty-seven minutes;
3. open space - the definition of class area is subservient to curricular needs.

Hurt pride is also in evidence. Only two weeks before my visit, the school board voted to eliminate the three "house captain" positions and replace them with one vice-principal. A house captain is a half-time teacher and half-time administrator, each relating specifically to one of the three houses. Their duties included some of those of an elementary principal, relating personally to the students and teachers in a given cluster; those of a vice-principal, assisting the principal with certain administrative duties; and those of department chairman, assuming curricular responsibility for one of the three areas of unified arts, physical education or music education.

The decision of the school board, presumably based upon economic considerations, is viewed by the principal and the teachers as the first move to eliminate the middle school concept in this district. When I asked why the middle school concept should be under attack, the following reasons were advanced:

> Membership on the board has changed since the decision to go to the K-5, 6-8, 9-12 plan. The current board does not care about the middle school idea.
>
> The principals of the two junior high schools in this city do not want to turn their schools into middle schools.
>
> Everyone is envious of this beautiful school and the education program. If they cannot have the same thing, they want to destroy it.
>
> Money has dried up. We cannot afford to continue with the long range plan.
>
> Changes in enrollment have resulted in a need to reallocate students to buildings.

The observer can make no judgements on the validity of the above reasons. It must be emphasized, however, that these attitudes were reflected in almost all conversations. Only the day before my visit, the above administrative changes had been effected, and this event was continually noted. As one of the children commented: "There goes Mr. _________. He looks so sad because he used to be our house captain but now he is just a teacher and we can't talk to him about problems and stuff anymore." A newspaper clipping was attached to the original report that expressed the situation as viewed by the teachers at this school.

Issues in Mind Prior to this Site Visit

Newspaper clippings and conversations with the site observer prepared me to look for the issues outlined below. While not all were in evidence, it must be noted that this report encompasses only one school in this district.

Budget cuts: How have they affected the curricular program, especially in science?

Budgeting constraints appear to be operational in the apparent move to depart from the middle school concept in this district. They may be playing a role with the teachers and administrators at other schools who do not have the facilities of the middle school. In the middle school itself, however, budget problems were not highly visible. The equipment and materials appear to be adequate, even luxurious compared to most schools. With respect to staffing, the highly qualified media specialist is actually filling a media technician position. And, of course, budget problems are the reason given by the board for eliminating the three house captain positions. It should be noted that the principal has been aggressive in obtaining funding for some programs, e.g., Title III ESEA Staff Development Funds, Title I funds for reading laboratories.

Development of program objectives: is this activity seen as a concern or a need?

A considerable curriculum development effort occurred in the planning of this school. However, no reference to this issue was made by any teacher. When queried, teachers generally replied that they knew what their curricular objectives were and had incorporated these goals into the instructional program. Not seen as a problem here.

Decline in student enrollments: how this impacted curricular programs.

Apparently not a problem in this new school that incorporated the sixth grades from area schools and the seventh and eighth grades from the nearby high school. However, changing enrollment patterns may be part of the reason for the apparent move away from the long range development plan.

Back to the basics: is there a renewed emphasis on basic skills?

"We've never left the basics" is a phrase often heard in this school. And, indeed, the emphasis on "hands on" experience was cited by some teachers as evidence of their commitment to basic ideas and concepts. Conversely, numerous comments were made about the lack of basic abilities of many of the students. Three programs are used to address the problems of children who are deficient in basic skills, but questions still remain about their success:

1. Individualized instruction programs are operational in mathematics and science (ISCS).

> *The mathematics program is excellent. The kids learn from it and I like it, but it can't be the only program. You also need a teacher who knows the subject matter at that level and incorporates his or her knowledge into the individualized program. You can't just put a kid into the program and let him or her go for years or even months without the teacher helping along. It's really an advantage to the brighter students who understand what they read. They can read the directions and progress at a much faster rate. But with the slower children who have problems with reading - they probably don't progress as fast as they could otherwise.*
>
> --- *Mathematics teacher*

> *The science program is great for kids this age. Ordinarily they don't get any physical sciences unless they take chemistry and physics in high school. Here they get an integrated program in the seventh and eighth grades. The sixth grade gets only one and a half hours of science a week; not nearly enough: I try just to get them ready for lab activities for the next year. In this program, they go at their own pace and perform the experiments themselves. They really enjoy it! We had several kids in science competition this year - I think this is primarily because they've had a chance to actually do things themselves.*
>
> *--- Science teacher*

2. Remedial reading program.

   Children who have reading problems identified are referred to the reading laboratories for special assistance. Specific reading activities are designed and individual instruction is delivered.

3. The school store.

   Approximately fifty children of "average or higher ability" but who have reading or math problems work with a remedial teacher in operating the student store. The teacher, a former business man with subsequent training in both mathematics and English, also holds special small group learning sessions with these students. The basic idea is to "teach the children that basic skills are required in everyday life activities." The children keep track of the inventory, make sales and figure change. In addition, they write and deliver commercials for the store via the daily closed circuit television program (to be described in the next section). The store operates during the last time period on three days each week. Unfortunately, I was unable to view this operation in action.

Additional Notes on Issues/Themes Noted During the Site Visit

Individualized instruction. As mentioned above, the individualized ISCS science program is viewed as an excellent way for children to be motivated to learn. Two science classes were observed in which children were performing various types of experiments. One group was subsequently interviewed and it was apparent that the children did not really know what they had been doing. They were following the text outline for the experiment - but were not reading the text information, consisting of eight or ten pages, that accompanied the experiment. When asked whether they had earlier read the text, they replied: "No, we don't have time for that."

> *One boy told his two classmates that the answer to question 24 was "No."*
> *"No, what?" asked one of the classmates.*
> *"It doesn't matter," replied another, "Just get the answer down."*

During the math class, one girl was observed taking a pretest. She explained to me that she was ready to check her pretest answers against the key. For each of five skill areas, if she does not get a certain proportion correct, she must work the skill pages for that section. When checking her answers against the key, she incorrectly "passed" herself on one of the skill areas. Question: do we simply assume that "deficiencies" that slip by will be caught on the next pretest?

> *Individualized instruction is the only way to handle a heterogeneous group of students. I have all levels in this class and cannot possibly*

> *work with thirty students. They help each other, of course, but I have to supplement the material with lectures.*
>
> *--- Mathematics teacher*

Difficulty level of materials. This issue was raised only by the social science teachers. Of possible interest is the fact that this is the only area (of science, math, social science) in which an individualized curriculum is not operative.

> *The seventh and eighth grade materials are not bad. But the sixth grade text is too difficult, even for the good students. It's way above their heads. We only have the text - no supplementary materials to go along with it. So much of the kindergarten through grade five social science curriculum is just memorization of facts. But here we're really trying to introduce thinking about the social sciences in a logical way. It should overlap with the other disciplines. But the text is impossible. I don't have much hope for any changes unless we could get supplementary materials.*
>
> *--- Social Science teacher*

"Hands on" learning. As mentioned above, the opportunity to do, to experience, was frequently mentioned as one of the best qualities of this school's curriculum. Previously described are the science and mathematics programs that integrate an individualized approach with the opportunity to perform experiments. In addition, the school store incorporates a unique philosophy related to "learning through doing." Other activities also deserve mention as reflecting this general attitude.

The Learning Resource Center is literally the center of the school. A well-equipped library is surrounded by comfortable lounge chairs. The number and variety of books, including multiple copies, is most impressive. A glance at the library checkout cards in the back of the books did not indicate a high degree of utilization, however. The Learning Center is open only during school hours and may be used for fifteen minutes before school, during the last period of the day or when a teacher sends students to the Center. When I asked why the Center was available on such a limited basis, I was told that kids this age are not as interested in libraries as are graduate students. I wonder.

Around the Learning Resource Center are twenty-four carrels with plug-in head sets and dial-up units. The children may dial (by pushing buttons similar to a touch-tone telephone) any one of thirty-two recorded audio programs. This facility is maintained by the media specialist and some programs are changed weekly. Examples of use include the German program in which eight- or ten- minute tapes are recorded weekly. Also available are tapes on photography, short plays, topics in social science. This facility is extensively utilized by the reading laboratories that can also remotely access the audio tapes. Equipment is available to record and immediately play back. An experimental use of this facility has been to record lessons for children with reading problems, so they might listen as they read along. Another teacher requested some music. It is possible to record the audio tapes from almost any source: other tapes, records, live performance. The kids love it. The teachers seem to be using it quite extensively.

Another program using the "hands on" approach is the closed-circuit television. This project is organized by the media specialist. Each morning a seven-minute program is broadcast to all classrooms. The program consists of "local" news, the weather for that day, upcoming events, announcements, etc. Included are the commercials for the local store.

The program opened with the Pledge of Allegiance and the Star-Spangled Banner. One girl operated the camera that was directed to a flag pinned upon the wall while another girl was focussing her camera on the two "anchor-persons of the day." Another student was operating the controls to determine which camera was "live" - televising the picture. Still another student was queuing up the video tape of the commercial that had been shot earlier that week. Another was operating the music level for fade in and fade out.

The two newscasters read their bulletins for the day with some rather professional switching from one to the other. The backdrop was set up for rear projection and another student was operating the rear slide projector to change the background scene as appropriate. The weather forecast was given for the day.

The entire thing looked like grand chaos. Eleven children running this show. One girl could not get the commercial ready and the media specialist quickly stepped over to help.

It was all over in seven minutes. It seemed like twenty to me. I was a nervous wreck.

"A great show this morning," commented a teacher right after the program. Another site observer had watched from one of the monitors in a classroom - it all looked smooth from that end, he later reported to me.

Throughout the entire production, the media specialist was everywhere - calmly and gently. "It's all in the idea of having fun. And they're learning that this is not so frightening. Anyone can work cameras and produce shows. Tomorrow we're going to try to videotape the weather portion of the program outside, just before school starts, and then play it during the program."

--- Notes from the observer

Science is for the future.

Visitor: Why is science important?

Student: Because we need scientists to go to the moon and make important discoveries.

Visitor: But not everyone will be a scientist, so why should all kids learn about science?

Student: Because no one knows what he will be when he grows up and we have to be prepared.... Anyway, even if we're not a scientist, lots of jobs need some science.

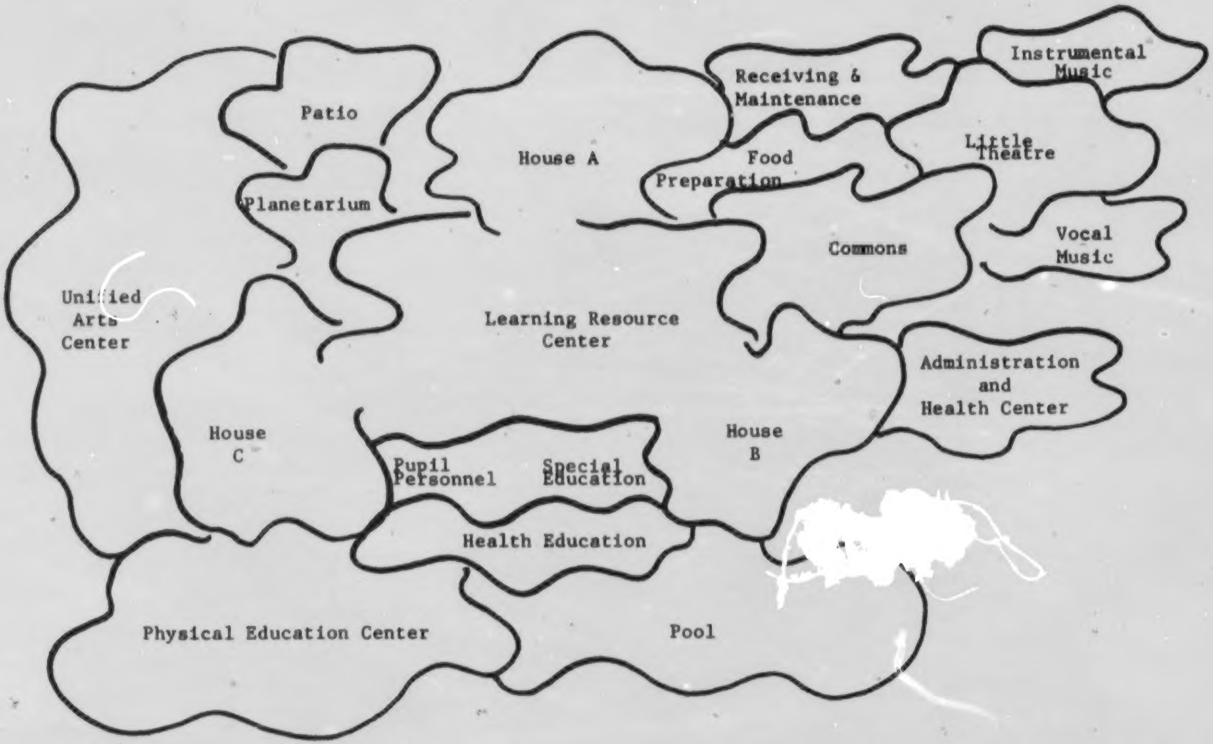
Visitor: But what about people who don't work in a job that needs science? What about mothers who stay home with their children?

Student: Well, they might want to go to work someday, and then they might need science.

Though the above comments are from students, the science teachers expressed the same ideas, albeit in more sophisticated language. Science is important because we might need it someday. No reference to consumer need. More importantly, no reference to needing science for today. Why?

Elizabeth K. Dawson

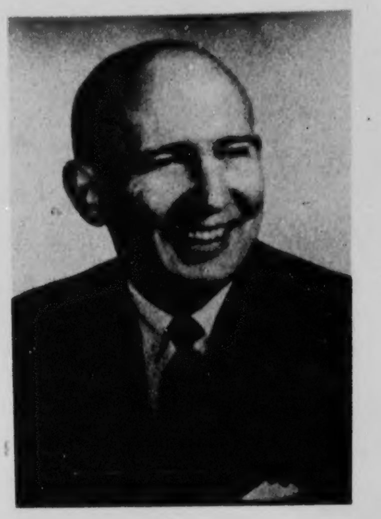
WEST VORTEX MIDDLE SCHOOL


Patio
House A
Receiving & Maintenance
Instrumental Music
Food Preparation
Little Theatre
Planetarium
Commons
Vocal Music
Unified Arts Center
Learning Resource Center
Administration and Health Center
House C
House B
Pupil Personnel
Special Education
Health Education
Physical Education Center
Pool

AREA RELATIONSHIPS

TOTAL CAMPUS

NOTE: This drawing is intended to demonstrate relationships between spaces and is schematic only. True proportion has not been observed, and shapes are not intended to represent desired design.



Gordon Hoke, Associate Professor of Education in the Center for Instructional Research and Curriculum Evaluation (CIRCE), University of Illinois College of Education, brings to the CSSE project a reputation as a specialist in innovation and school-community relations. His experiences include two years directing the Demonstration Project for the Education of Gifted and Talented Children, Sterling, Illinois (jointly sponsored by USOE, the Illinois Office of Education, and the University of Illinois), and participating in several research and evaluation projects with CIRCE. Currently on sabbatical, he is conducting a study of rural development in industrialized societies.

Gordon received his Ph.D. from Michigan State University in 1965. His background includes high school and junior college social studies instruction, as well as teaching at the university level. He has participated in numerous special institutes and conferences, serving as a presenter at conferences in Bucharest (1972), Toronto (1974), and Allerton Park (1976). In addition to his work through CIRCE with such groups as teachers in early childhood education, and in cooperative extension services, Gordon has also served as a consultant for a variety of educational and social service institutions. These include state departments of education, community health service organizations, and numerous parochial and public school systems throughout the nation. Among his publications are articles on the "custodial obligations" of British and American secondary schools (Comparative Education, March 1966), and on community involvement in public schools (Illinois Principal, Fall 1973 and Spring 1975). He is also the author of Goodbye to Yesterday: Talent Development in a Changing Era, a report of a school-community study in Effingham, Illinois, 1971-72.

Gordon and his wife, Marilee, and their three daughters currently live in Champaign, Illinois. He is, however, an aspiring member of the Chamber of Commerce of Arthur, Illinois, and is known in CIRCE circles as Arthur's "Chief Booster."

Chapter 11

CASE STUDIES IN SCIENCE EDUCATION:

GREATER BOSTON

Rob Walker
CARE
University of East Anglia
Norwich, England

April 1977

"It's difficult to describe something to someone who has never been there."

(Dick Gregory in the film *Chicago Blues*)

"The Commonwealth requires the education of the People as the safeguard of order and liberty"

(inscribed over the Boston Public Library)

11

Britisher Rob Walker has managed to challenge seriously three of my pet assumptions in one fell case study. My guess is he will do as well or better with other readers of this penetrating study of science instruction in an urban high school.

As a parent raised in Detroit, a parent who tried unsuccessfully a decade ago to cope with a son's terror-filled life in a large east coast secondary school, I am encouraged to learn of an urban high school which does not fit an image developed over two generations.

Further, as a case study writer who was taught his trade in the Meredith Wilson school of ethnography, I am now dubious about our first principle, "You gotta know the territory." Rob Walker shows what intelligence, skillful interviewing, meticulous observation and dogged tenacity can do to overcome his outsider's handicap.

Finally, I am much more open to the concept of a magnet school as a result of Walker's work. Heretofore, the magnet school was grouped in my mind with other such feckless products of the modern educational industry as change agents, product champions, experimental schools and career education.

What I am left with is a strong case for the probable existence of an urban high school which honors academic interests, one that draws multiracial talent from many sectors of the city. Mr. Walker's keen eye and writing skill are revealed in the tale that follows, one which will both establish his eminence as a nonpareil recorder of educational practice and enhance our understanding of the instructional realities of urban high schools.

Terry Denny

CASE STUDIES IN SCIENCE EDUCATION: GREATER BOSTON

Rob Walker

UP IN THE MORNING AND OFF TO SCHOOL

Seven ten a.m., and after a hurried breakfast Pete finds himself out of the house and driving his traffic-scarred car towards school. He has to start early so that he can sign in before 7:30, fifteen minutes before homeroom.

There are no direct highways to the school, and the city is noted for its elaborate, and often antiquated, road system. (Local legend has it that the roads follow what were once cow tracks.) Strangers to the city spend much of their traveling time lost or disorientated. Pete's route is well-worn and familiar, but nevertheless he spends much of the journey sitting at lights, waiting to turn into traffic, or inching along what a little later in the morning will become a major traffic holdup.

It's a frustrating start to the morning. Pete frequently finds himself cursing the driver in front who won't stay in lane, or the car that blocks the turn-left arrow at the lights. A cyclist pulls sharply across in front of him at an intersection, causing him to brake suddenly. Pete leaps out of the car, grabs the small black kid by the coat and shouts at him. The boy hangs his head and mutters an apology. Two hours later Pete confesses to some of the teachers in the teachers' lounge that he feels bad about the incident and that he surprised himself at his instant aggressive response. But it is an incident that haunts him the rest of the day, and later that night he depresses himself thinking again about his time in Vietnam. Back in the car he consoles himself with the thought that the teachers who live out in the suburbs leave home half an hour earlier, and suffer more from traffic holdups and bad weather. The banks of frozen snow at the side of the road are a reminder that at any time the weather can make the drive more hazardous and double the time it takes.

The traffic is worst within two blocks of school. As he follows an ancient tramcar that always reminds him of those movies about wartime Poland, the front wheel of the car drops into a deep hole in the road, sending a shudder through the front suspension. It is with a sense of relief that he finally turns off the main road into the area surrounding the school.

The morning news on the radio continues its daily narrative of wheeling and dealing in city politics, and the view through the windscreen adds its own commentary to the story. This is a city dominated by public institutions. Fifty universities, another hundred colleges of various kinds, several major hospitals, the world headquarters of a major church, a score of nationally-known museums and galleries, and one of America's finest symphony orchestras. Within a quarter-mile radius of the school, which occupies a new ten-floor building on a restricted site, are three large hospitals, four or five colleges, and the city's most prestigious (examination entry) high school. It is an area where people work, not one where they live, and the work they do is over-whelmingly that of a service economy: teachers, students, doctors, nurses, and a minor army of custodial staff, security men and cleaners. Parking is a nightmare.

The radio interviewer is talking to an economist about the overall state of city finances. The economist is saying:

> *Culturally, this is a rich city; but partly because of that, its tax base is sadly depleted. We've no major industry here, no natural resources, no cheap supply of energy. We may be a national centre culturally speaking, but in economic terms we're really only a regional centre. Compared to the other great American cities, we're poor and getting poorer. Everyone talks about New York city going bankrupt, but New York has seen a period of economic growth we've never seen. We're perhaps the last of the great old American cities: an immigrant city the poor pass through on their way to better things, and if they don't pass through they just get left behind. It costs a lot to keep this city going. Look at the schools: it costs twice as much per high school student in the city compared to the rest of the state, an average cost that actually gets greater per student as numbers in the schools decline. With 55% of the city tax-exempt, we are rapidly reaching the point where we have to decide whether or not we want to maintain life in the city at even its present rather low ebb. It's like the decision you have with a coma patient. At what point do you withdraw life support systems?*

The interviewer seems taken aback by this uncharacteristic outburst. Floundering for a question, she asks, "Do you think there is any chance of things getting better?" "That's not the question," the economist replies; "The question is, how much worse is it going to get?"

Pete's car runs down the slope into the school's underground car park and the concrete walls shut out the radio signal. "Oh well," he sighs out loud to himself, "another start to another day."

ANOTHER START; ANOTHER DAY

After they sign in and collect their mail from the first floor office, first stop for most teachers is the teachers' lounge on the fifth floor. Selecting a key from the twenty or more most teachers carry, Pete summons the elevator. Most students use the escalators; but as the elevator door opens, a girl with crutches and a leg bandage emerges. Handicapped students are quite common in school, but as the elevator travels upward one of the teachers jokes, "You know I'm sure some of these students just carry crutches to ride the elevator."

At the fifth floor there's a rush for the teachers' lounge. Promptly at 7:30 the door to the coffee urn closes ("Otherwise we'd never get the teachers into homeroom," explained an administrator). Pete passes his head of department; "How's life in your lily-white suburb?" he asks. Bill has been teaching in the city long enough to have seen everything at least once before. "Your turn will come," he says. "Never, never," says Pete emphatically. "You think not?" comes the knowing reply.

Being a new school it invites criticism from its inhabitants ("an architect's dream and a teachers' nightmare"). Whatever the complaints, it's an interesting thing about the school that once inside, you lose much sense of what lies outside. It's one of those things that is so obvious to all the teachers that they have long since ceased to question it. The only people you ever see staring out of the windows are visitors, unless there is a baseball game being played (the scoreboard faces the school). Pete feels it not so much an architectural feature of the school but a feeling of belonging, of familiarity and recognition. Once inside school, he feels secure; he likes to be there. Enough teachers feel the same way that it is not something they need to talk about, or feel the need to hide.

To someone whose image of an inner city school is one of hostility or human desolation, it no doube seems strange that a good many of the teachers, and some students, feel at home here. Teachers who have been here for some time say it has always been like that, partly because for many years this has been a school that took students on a city-wide basis. Even when, in the late sixties, it became a predominantly black school, it was never really a neighbourhood school like many other high schools in the city. It seems the circle of colleges and hospitals that surround the school have effectively insulated it from the streets where students live.

From the interaction of architecture and organisational history has arisen a distinctive psychological ecology. Pete has noticed that only very rarely do people pin things on walls or bulletin boards (the main exception being administrative or guidance offices; few classrooms or teachers' rooms are so decorated). In a lot of places people have drawn the curtains across the windows and leave the lights on all day. Perhaps initially they do so to reduce the glare from the winter sun; but often once they are closed, they leave them that way. After a while you take these things for granted.

Like hospital or prison, you might think; being inside. But no, Pete would say, there is a difference between being closed in and being shut in. "I like it here, I like being in my classroom. I like the kids. The other day I was sitting in my classroom; just sitting watching the students and someone came in and said, 'What are you doing? Do you feel alright?' And I said, 'Sure, I'm just watching my class.' I think he thought I was crazy." Perhaps surprisingly, this is the kind of thing you hear quite a lot amongst the teachers. Bill, the head of science says, more than half seriously, "When I want to relax, I shut myself in my room with a class of students." It seems there are enough teachers in the school who are concerned and committed, and above all who like teaching, that such a confession isn't just a joke. A major source of motivation for many teachers is not altruism, idealism or even the desire to educate, but simply their enjoyment of the social contact, with students and other teachers, that the school provides.

Whatever outside commentators may say about the state of the city, and the state of education in the city, inside the school it is difficult to detect any feeling that things are getting worse. In fact, given the turmoil of the last ten years, most people seem to feel it is a remarkable accident that the school is here at all; a circumstance akin to the origins of life on earth, one science teacher suggested. This is not to say there are no problems, but it does seem that few people feel that the problems are unmanageable or out of control. In the words of the principal, referring to the turmoil of the past decade: "I think we've turned the situation around."

Attendance remains a major problem, and one that consumes considerable personal and organisational energy. According to the figures, attendance is about 70%; but this statistic disguises considerable tardiness and some cutting of classes. Yet you don't have to be in the school long to realise that whatever the attendance figure is, it is high. If you were to replace the curriculum with more traditional courses, withdraw the concern and care of the teachers, and above all take away the joking and humour that many students meet from their teachers and from the aides, that percentage would certainly fall, and perhaps dramatically.

The school administration works hard on the absence/tardiness problem, and most teachers do what they can: scolding, cajoling, encouraging. As Pete walks down the corridor to his room, he passes a girl he hasn't seen for some time. "Well Hi, Janice, great to have you back. How was Florida? You mean you didn't to go Florida? Where was it then? Bermuda? Oh those beaches and the palms! Don't tell me you've been in Buffalo with a suntan like that?" The pale-skinned girl smiles and blushes and walks on. She's going to meet a lot of such attention today and a group of friends hang around her, partly in support, but also because they enjoy being part of the scene.

Monday morning, first period. It's not difficult to find classes half full. Some of the students are no doubt in the building or on their way to school, but teachers long ago accepted that continuity from class to class was problematic. They have got used to overlapping the course from class to class; to reviewing and repeating, to falling behind on plans that are too ambitious and to thinking ahead only one lesson at a time. But when you look again, what is surprising is not how many students are absent, but how many have turned up. The students who have been working all weekend, and in some cases all night. Those from crowded homes or housing conditions where getting sleep is always a problem. The pregnant girl still suffering from morning sickness. The kids who are popping pills. The black boy who feels that school must have something to offer, but still can't see what it is. (In a rare cynical moment a history teacher said to Pete, "Perhaps he was the one the Civil Rights movement was for. Or maybe he was just the victim.") If the school's efforts to keep attendance up were merely oppressive, a lot of the students who are coming, wouldn't. "It's a difficult line to draw," explains one senior teacher, "between wanting them here and making them stay."

Whatever the feeling in the city as a whole, for the school there is little sign of things about to get worse. Perhaps three years ago people felt that way, but not now. Most teachers feel confident that they can at least hold the situation at its present level, and some are hopeful that significant improvements can be made in terms of curriculum and teaching. Those in more experimental programmes (like the Reading Lab) are more immediately aware of imminent financial cuts and the effects of the school board's use of output measures to assess the efficienty of schooling, but most teachers remain unaffected.

Why the school feels itself to a large extent autonomous and not really an integral part of the city school system is not puzzling when you know its recent history. The legacy that remains from three years of court-ordered desegregation is virtually a total lack of confidence in the central office administration and the school board. ("The Judge runs the schools," was how one central office employee put it.) The school feels it has been left to cope with situations not of its own making, that decisions have frequently been taken on political grounds without reference to what happens in schools. The teachers have learned to cope and to expect little in the way of help from outside; and the effect of that has been at best independence, and sometimes suspicion, of agencies beyond the school, and a deep antipathy to the very middle class suburbs where many teachers live. The exception has been in contacts with higher educational institutions. Thanks to a large input of effort on both sides, some of the links with teacher education colleges, and with various colleges participating in the magnet scheme, seem strong and even productive.

Loss of confidence in the central administration of the school system on the part of many teachers is one reason why the school feels autonomous. A complex feeder pattern, which means the school has few close links with other schools in the system, is another. An important consequence has been that the school appears to have set its own limits and its own targets; few fingers of blame are pointed at the outside world. Teachers may express cynicism at the politicking of the school board and the superintendent's office, and they will point to the home and family circumstances of the students as prior conditions of schooling. But for the most part, such references are in the nature of comments rather than explanations or excuses. Like many of the other teachers, Pete feels that if you teach in the school you have to accept these things for what they are; but once in the classroom, you have to confine yourself to the problems of the moment. Judging from what people say, this seems a change from the late sixties, when all problems were seen primarily as problems external to the school, and virtually beyond control.

"Things have changed a lot since the sixties," one long-established teacher says. "Everyone talks about how much the students have changed, but the teachers have changed, too. Everyone is more realistic about what is possible - but don't get me wrong, they are not necessarily less idealistic. It's just that they are not about to burn themselves out on one dramatic and possibly futile event."

Writing about the city's failure to agree on charter reforms that would allow some minority representation on the school board, the morning newspaper had despaired at this "city that is changing, but has not yet changed." Change is certainly easy to detect in the context of the school, even though there is currently a feeling of life settling down to some kind of pattern. The guidance counsellor, who has been at the school throughout the last decade, emphasised this view:

> *In the sixties we lived through a difficult period. At the time of student unrest in the universities we had the SDS and the Black Panthers in the school, both fairly determined to overturn it. The idea was, apparently, that if this school was to go, then the whole system would crumble. We survived that, interestingly, because of the support we got from the majority of the students; but we survived it only to run straight into desegregation, busing, the courts virtually running the schools. Actually we came out of that quite well; this was a black school that came out of busing well, and if the courts hadn't stepped in, the school board would probably have shut the school down. But still, day-to-day in the halls and the classrooms it was a trying period and not without tension. Now it seems there's been another, perhaps more sublte change. The students seem to know more what they want from school, and also what they can expect, and perhaps that's true of the teachers, too. I'd say there's less fervour and more hard work going on in the building than there was a few years ago. The changes we've seen in the economy seem to have made their biggest impact on education; certainly the change of job prospects seems to be having quite a profound effect on students' attitudes and values. Of course we still have enormous problems, but the school seems less volatile, more stable, than it has done for years.*

Not everyone would share his view. One young teacher told one of the site visitors that she thought racial tensions in the school were only just being contained and she clearly felt that conflict was imminent. Yet overall, considering the circumstances, it seemed to me that morale was high. The predominant mood of human contact (whether teacher-student or student-teacher) is humour with the mock insult as the preferred form; a mood that can only survive under circumstances of some mutual trust.

CONVERSATION IN THE TEACHERS' LOUNGE

Pete's a young teacher, and may not be typical. The school does, though, receive a large number of visitors, and I asked some of them what were the things they noticed. One of the things that often strikes visitors to the school is the nature of conversation in the teachers' lounge. Most people, most of the time, it seems, are talking about teaching. Not carping or complaining, but discussing teaching, the students or the subjects they teach. As a regular visitor I found myself looking forward to going into school simply for the conversation. People talked to me about the school, city politics, their childhood in the city, the merits of Rudyard Kipling as a writer, tree ring dating, germ warfare, sun spot activity, the origins of Indo-European languages, the brilliance of Tom Stoppard, a recent Symphony concert, how last year they cycled to California, the Maine desert, gas chromotography, French opera, tectonic plates; a verbal encyclopedia of topics. Sometimes I wondered if it was something about me, so I'd sit quiet and listen to what others were saying, but it would be the same all around the room. Often I'd find myself wondering at the educational resources contained in that room.

Of course many teachers avoided the room, and some spent more time there than others, but that doesn't alter the fact that the tone and climate of the place was unusual. Physically it is not a very comfortable, attractive or welcoming place, and some teachers preferred to find other niches in which to relax. Others get too busy. One young teacher told me he avoided the place because he liked to read, adding, "I don't want to become one of those teachers who comes into class, puts some page numbers on the board and spends the lesson reading the newspaper. If I can't be a good teacher, I'll go and do something else. Life's too short to spend time as a mediocre teacher." Such single-minded dedication is, however, unusual, and most teachers spent some time each day in the lounge.

In this section I want to use some teachers' lounge conversations as a lead into what seem to me significant educational issues. At the end I'll return again to the room itself and say something about that.

Conversation 1
The Role of the Experiment in Science Teaching

Steve: *(Looking through a workbook of experiments David has been using in his class) The trouble with a lot of this stuff is that it is so obvious. Even when you have done the experiment, you only know what you knew already.*

David: *Maybe it's obvious to you, but it isn't always obvious to these kids. To some of them maybe, but not to all of them. Sometimes they do know what is going to happen in the experiment, but they only know it vaguely; they haven't really thought it out.*

Like this morning we were talking about that experiment where you float a cork in water, then push an upturned glass down on top of it. They did the experiment and saw what happened. When I asked why the cork went down, one girl just said "gravity." Well, you can see what she means; it does involve gravity, but that's not an explanation of what you see happening.

Steve: *Yes, but you can't say that's exciting, Floating corks in water. I want to get these kids interested in science. I want experiments you can do which set them all off saying, "Wow! How did that happen?" Something that really challenges and excites them.*

(Looking at the book) Finding out 20% of the air is oxygen. That's no challenge. Why not just tell them. You shouldn't just have to do an experiment for everything, only if it excites them or triggers them off.

David: *But before you can work on these dramatic experiments they have got to know scientific procedures and appreciate the methods. All this week I've been emphasising the five stages of writing a lab report and getting them to appreciate the difference between observation and explanation. Those are not things you can just tell anybody. You have to do it several times and it takes practice. And for most of them, writing a scientific report is not something they are used to doing; in fact some of them have got so used to multiple choice tests that it is an effort for them to write complete sentences.*

Steve: *Maybe you are right. I think teaching them rigour and method is a useful thing to do. The danger, though, is that you end up just pacifying them. The science that is going to affect their lives isn't the five stages of writing a lab report. It is nuclear power, pollution, recombinant DNA research. Those are the things I want them to know about, and I want them to be able to pursue things for themselves, not just because they are in a course or a textbook.*

This conversational fragment takes us immediately into a number of crucial science education issues.

> *What is the nature of science? Is it new ways of looking at things we usually take for granted, or is knowledge at new frontiers? Is it methodical, disciplined and perhaps sometimes boring; or is it imaginative, free-wheeling and perhaps sometimes incoherent?*
>
> *What part should experimentation play in science teaching? Is science primarily theoretical?*
>
> *What part should applied science, and the applications of science, play in the school science curriculum? Should science teaching start from the applications and only work back to the theory when necessary and as far as necessary?*
>
> *Or should understanding of applications come only on the basis of theory, as a pinnacle (or afterthought)?*
>
> *What part should social, cultural and moral values -- as opposed to scientific values -- play in science courses? Does science have its own morality, its own ethical standards? Should these be taught?*

This case study cannot offer answers to such questions, but it can point to their reality, at least for these teachers. It can also offer supplementary detail which might help fill out the brief scenario that heads this section.

The Teachers

David and Steve both teach ninth-grade earth science. This means they teach one period a day to each of four classes, and have one team meeting a day with the English, math and civics teachers who teach the same students. On paper they therefore have only one preparation a day; but they both said that classes vary so widely in attitude and achievement that two, or sometimes three, different kinds of lessons have to be prepared on the same topic.

Both David and Steve have been teaching four years, and have done all their teaching in the city. David trained primarily in biochemistry (to Master's Degree level) and nurses an ambition to teach a biochemistry course at high school. Steve majored in history, but with enough science courses to be able to get accreditation as a science teacher. (He is the one science teacher who invariably wears a white lab coat. The joke is, that when he walks away from you he reveals a large picture of Woodstock emblazoned on the back.)

Once teachers have been employed in city schools for four years, they have tenure in the system. At the end of last year both David and Steve were formally fired (at the last possible date), and didn't know until hours before school started this year that they were going to be offered employment. Ninth-grade earth science is the bread and butter of the science department, employing five of the department's twelve to fourteen teachers (depending on whether you count those teachers in alternative programmes). David knew that he had to be prepared to teach ninth-grade earth science. Steve knew he was more likely to be offered a job teaching science than history, and that in science the demand was for ninth-grade teachers.

In one sense both teachers found themselves in their present jobs by circumstance rather than choice, with the exception that they both wanted to remain at this school. On the other hand, it would be misleading to push this point too far. Both are concerned teachers, highly regarded by their students and their head of department. They work hard at their teaching, sometimes to the point of obsession (Steve came back from the one-week winter break saying, "That's the first time I ever remember being away from school for a week and getting so that I just wasn't thinking about the kids any more"). Most days they can be found in the teachers' lounge or the lunch room discussing science, their course, their classes, or all three. ('We're still new enough to be pretty gung ho" David explains, as if to apologise.)

Although there is a lot David and Steve share in common, there are also differences between them: intellectual differences (as in the conversation we started with), and differences in style. In class David likes to set a climate of quiet and order; he goes to some lengths to keep his room clean and tidy and uses the arrangement of the room to accentuate his presence (a striking black board helps, too). His classes are carefully structured in the sense that he often fits three or four different, but related, activities into the forty-minute period; all the while keeping a sharp eye on those who drift from the task at hand. He presents himself as hard working and serious (both words students used to describe him), but a cynical, reflexive humour is never far from the surface. (It's a difficult kind of humour to describe but it seems characteristic of the city. Perhaps its main feature is an assumption that everyone always acts from the worst of all possbile motives, but that the teller has seen it all many times before.)

Steve's style is more extrovert: he wears his ego on his sleeve ("He puts such a lot of himself into his lessons," says one of his students). Teachers commonly protect their vulnerabilities by displays of authority, but Steve seems to enjoy putting himself at risk. He often seems to be pushing at the bounds of the conventional, especially out of class. Walking around the school with him can be like following the Pied Piper; students appear at doorways and follow him 'round. It's a continuous performance, humanising what must sometimes seem an inhuman institution. (Perhaps it is misleading to single out Steve in this way, for it is a quality many of the teachers, and some of the aides, share in different ways.)

One of the things students in both David's and Steve's classes agree on is that they separate the social and the academic facets of schooling. "He'll actually say to you, 'I think you're a lovely person, but on this work you get an E.'" That attitude, the students claim, is unusual. "There are so many teachers who think they can get 'round you by giving you better grades than you deserve." A concern David and Steve share is for standards, and it seems to communicate itself to the students.

The following record of observations in David's first period class, Tuesday and Wednesday, reveals this.

Tuesday. There are nine boys and eleven girls in class and it is one of the middle sections. David is talking to them about the lab reports he wants them to write:

> *I want you to assume I know nothing. Someone reading your lab report only knows what you tell them. I want you to report everything, so that when I read them, if I was someone who had never done the experiment before, I could read your lab report and know what to do, and what I would find.*
>
> *Now you have three experiments I want you to do to show that air exists. One of the experiments I want you to do will take a day, so today do these two because I want you to hand in a report today. Yes, everyone is to hand in a lab report at the end of this period. You can work in twos or threes, or on your own, but everyone has to write their own lab report.*

(Someone asks, "Do you write it as you are doing it?") It's a good idea to write things down on a scratch pad while you are doing it. Remember, nothing is too simple to write down. What's the first thing you write? Your name and a title, that's right. Second? Equipment and materials. Write down everything you use, even if it is only a little spatula, because if I am trying to do the experiment from your report I want to be able to take out everything I need before I begin the experiment.

Third is what you do. We call that procedure (writing it on the board). Fourth? Fourth is observations. Remember nothing is too simple to write down. Fifth is conclusions. That's where you look at your observations and look at what you are trying to prove and make some conclusions.

Tomorrow we'll go over it and I'll give you the correct conclusion. Everyone should get the same result; but it's your personal conclusion I am looking for, so you may report the conclusions differently.

David gives out the jam jars and they get to work on the experiments.

Wednesday. Twelve boys and twelve girls are in class and two more girls come in late. David sends one of the students out to fetch notebooks for the class:

Today we are going to be setting up the wire wool experiment. That's the one that is in the back. It'll take about fifteen minutes to set up but you'll have to leave it until tomorrow before you get the results. Last night I went over your reports on yesterday's experiments and I like the way you did it. When you get your notebooks I'll go over it.

He gives out the sheet which describes today's experiment. It involves washing wire wool in vinegar, stuffing some in the end of a test tube, inverting the test tube in water. By marking the water level in the tube, students can estimate the amount of oxygen used up in rusting the steel. He goes through the procedures carefully. ("You need to use the vinegar to remove an anti-rust coating they put on the wool.") Within ten minutes the experiment is set up (five groups) and he moves the students back to their seats. The notebooks are given out and he goes through yesterday's lab reports.

The first experiment involved pushing an inverted drinking glass into a jar of water and finding that bits of paper jammed in the bottom of the glass remained dry.

"This experiment shows that air exists, that it has pressure and takes up space. If you tipped the glass to the side, what would happen?"

"Bubbles."

"Bubbles, yes you'd get bubbles; what would be in the bubbles?"

"Air."

"Air would escape in the bubbles, and what would happen to the water level in the glass?"

"Go up."

"It would go up. It would rise because there would be less air in it to press the water level down. The air would take up less space. What if we put a hole in the end of the glass?"

"The air would escape."

David writes on the board: "Conclusion. Air is all around."

Air is all around and occupies space. ("Those are the key words," David comments.) The drinking glass contains air. ("I'm going to do something different this semester, I'm going to collect in your notebooks, and those who take the notes will get credit for doing it.") The water pushes against the air, but can't enter unless the drinking glass is held at an angle to permit some of the air to escape.

David next demonstrates the second experiment, which is to float a cork on water and then press it under water with an inverted, air-filled drinking glass.

"Describe where the cork is," David asks.

"Below the water."

"Right," says David. "The pressure of air presses it down. Air occupies space. Air has weight. If I tilt the glass, air escapes and the cork will rise. I'm going to put the answer I want on the board."

He writes: "Conclusion. Air is a substance ('Just like solids and liquids'). Air is a real substance and takes up space just as do liquids and solids. The air presses down on the cork, forcing it down. Since the drinking glass is full of air, no water can get in unless we first let some air escape." He reads it out loud and waits for the class to write it down.

> *You may think these are things you knew all along (he says), but I want you to get used to putting it down in this form. Let me give you a word of advice. I'm going to be giving you some notes each day; if you miss a class, make sure you make up on the notes. You won't always be able to catch up on the experiments, but make sure you get the notes. . . . For homework, I want you to find out what gases compose a volume of dry air.*

With ten minutes of the lesson left, he begins a class discussion:

"Where does our atmosphere begin?"

"At the ground."

"Where does it end? How high? (pause) Is a thousand miles too much?"

"No."

"Actually it's nearer two thousand miles. But most of it is concentrated in the first thirty to fifty-five miles. Has anyone ever climbed a mountain?"

(Some yeses)

"If you ever climb a mountain, or go to Denver, you know that the air gets thinner. Denver is at 6000 feet, and that high the air is thinner than it is here near sea level. So most of the air is in a thin layer around the world, and it's in that layer that we get weather. Can you give me a definition of the layer?"

"Earth's atmosphere."

"Remember the definition I gave you the first week?"

He writes on the board: "The great ocean of air that extends thousands of miles above the surface of the earth and gradually thins into outer space."

"That's the definition I want. . . . Man lives at the bottom of this great ocean of air. Can he survive all the way up in it?"

"No."

"What would he need?"

"Oxygen."

"How would he take it?"

"In tanks."

"He'd probably need protection from radiation as well."

David goes on to introduce the topic of aerosol sprays:

> *They contain freon which is a gas that is lighter than air, and rises through the atmosphere to react with ozone [a kind of oxygen], making little holes that let radioactive particles through. Since we started using these spray cans the number of cases of skin cancer has risen 200 times. . . . If we stop using spray cans by 1980, it may be in time to stop it getting worse. It won't be any help to those people who already have skin cancer. We can't go back to where we were, but we may be in time to stop things getting worse. . . . You can't hide from radio-activity, it penetrates everything. Lead will protect you from alpha-particles. . . . We know gamma rays exist but we don't know their effects. . . .*

David and Steve both find that they need to plan their lessons for the lowest ability groups quite differently from those for the higher ability groups. Sometimes, as with the air experiments, David will say he'll try it with them, but at other times he will do something quite different.

Both teachers are working through the part of the earth science course that deals with the atmosphere and goes on to look at weather and climate. Both of them are trying to establish the idea that air has substance, and that it has characteristic properties. We have seen how David has set about this problem by having the students work through a number of experiments (which are not all in the text), which cumulatively he hopes will give the students a feel for the key concepts. It is crucial to his approach that the students do the experiments themselves (even if they know what will happen) because the tactile sensations involved are as important as the demonstrations and explanations.

With his low ability group Steve, too, is trying to get the students making things. But feeling they would be bored by the kinds of air pressure experiments David is doing, he has them making models of atoms using polystyrene spheres. The students could set their own level by choosing which atom to build; and then, having coloured the spheres (red for protons, blue for neutrons and white for electrons), have to assemble a model using wire and a wooden base board.

In his other classes Steve is using a trial curriculum project from a mid-western university which is orientated to career education. Although it involves a number of teachers from different subjects, Steve seems to have made it into a course on pollution (whether this is his emphasis or the project's it is hard to make out). With his usual enthusiasm, he is planning to take off a day without pay so that he can attend a regional conference on ways of teaching air pollution by experiment.

Conversation 2
Grouping and Standards

Mike is a biology teacher who has been teaching four years. John is an ex-student of the school who has been a teacher here for over twenty years. He used to be in charge of ROTC, but when that was phased out a few years ago he was given the job of teaching health education. Although he does not formally belong to the science department, the boundaries are fuzzy; some science teachers also teach health education, and John has a room on one of the science floors of the building. He told me he also has a son who is involved in curriculum development ("He works with someone who has license plates on his car with the letters BSCS").

Mike: *The real problem here is trying to teach classes where some students want to learn, and perhaps plan to go to college, but where these students are mixed in with other students who don't much care and who took biology just because they like the idea of cutting up frogs.*

You can't teach to the level of the good students because the rest get bored and start disrupting the lesson and it gets so you don't like to let the scalpels out. And you can't teach to their level, because then the good students feel you don't care about them, and then they get bored and complain that science isn't really very interesting.

The only answer I can see is to separate the two groups, so that at least you get those students who are interested and want to learn together in one group.

John: *But if you do that it's called discrimination. And we know all the problems that follow from having that kind of grouping.*

Mike: *Well, grouping is illegal in this state anyway, but it still seems to me that that is the real problem. I am a science teacher. I want to teach science. But how do you teach science to students who have the intelligence and want to learn when they are all mixed in with a lot of students who just don't seem to want to know?*

I can see why you don't want tracking or grouping in a middle school, or even in ninth grade, but when you get to more advanced courses the teaching problems are different. If you are going to maintain standards, you have got to have classes where at least most of the students are interested and want to learn. Otherwise our courses will not be what they say they are.

John: *But in the end you have got to make a decision between having an elite group, where you put the best of everyone and everything together, and having a more democratic system.*

I've been involved in special elite groups [in the services], and I know how effective they can be, especially when you want to get something done in a short period of time. But the problems we face as teachers aren't just the problems of teaching science, or the problems of teaching anything else for that matter. It can be hard when you find you are not maintaining standards like you once did, but the problems are not even just educational problems.

> *When I look at the problems schools face, I think the only answer is for us to put our trust in democracy.*

Mike: *Some students do want to learn, and perhaps that makes them a special group. Often, though, they are not getting a chance because of the way we mix them up with those who don't want to learn. You talk about democracy, but is that really democratic? Taking freedom away from some to make them like everyone else?*

Conversation 3
Biological Warfare

Bob, who teaches the second and third year biology classes, was talking about one of the bacterial cultures they used:

> *It's a nice one to use because it is bright red and you can get some pretty effects with it. We always thought it was harmless but it seems in rare cases it can cause pneumonia. It's one of the bacteria the Army released in the New York subway to study the spread of micro-organisms.*

It seems an amazing story, but sure enough Bob brings in a newspaper clipping two weeks later which reports the story. Yes, in preparing for biological warfare, the military did quite a lot of experiments over a long period to study the spread of micro-organisms. The New York subway was one of the source sites chosen, and it was true someone had recently died from pneumonia contracted from the bacterium.

Bob told the head of science he had called the Science Centre to tell them he was destroying his cultures. "And over there," he said pointing out the window to one of the nearby universities, "they are probably doing recombinant DNA research with very similar bugs."

Conversation 4
"To Serve Man"

David comes in with a science fiction volume under his arm. It appears he is a keen devotee of the genre. "I'm going to read a story to my last period class" (his low ability group). "I've decided science fiction is probably more relevant than science to a lot of them."

The story is called, "To Serve Man." It is about an alien group who arrive on Earth and solve all our problems, technological and social. The hero of the story is suspicious of their motives and questions their altruism. He obtains a copy of a handbook the aliens have called "To Serve Man." After months of work trying to decipher the strange language, he learns (in the last sentence of the story) that the book is a cookery book.

Conversation 5
Between the Clusters and the College-Bound

Three experienced teachers (science, modern languages and English), none of whom is involved in ninth-grade teaching, are discussing the merits of the cluster system.

A: *There shouldn't be any need for the clusters. If the office downstairs were doing their job, there wouldn't be a problem.*

B: *I disagree with you about that. There isn't another school in the city that can handle the problem, whatever the administration does.*

A: *Well I think there are other schools that have a stronger administration that do a better job.*

B: *You can't say that things aren't much better this year than they were last year.*

A: *I don't know about that. The trouble now is that kids are being kept in school who would have dropped out before. I know the figures look good, but the problems of classroom discipline are worse because the teachers are having to cope with kids who don't want to be there.*

C: *I dread to think what will happen next year when those same students come back and they are no longer in clusters. It will be chaos.*

The ninth-grade cluster system emerged partly from the collaboration between the school and a local university. It has its disadvantages, reducing flexibility in departmental scheduling. (Because "cluster times" are concentrated at the beginning and end of the day, other subjects get jammed into the middle.) It is also heavy on staffing; because cluster teachers teach four, rather than five, periods a day, the system requires overall an additional five teachers.

Generally the scheme is counted as a success. Teacher A is unusual in his view, though his point about the scheme containing difficult students and thereby increasing its own problems contains some truth. Behind his remarks lie other, less often expressed but frequently felt, feelings of distinction between the ninth-grade teachers and those who teach more advanced or more specialised courses. For the most part, the ninth-grade teachers are younger and more junior; they do not lack experience, but they tend to be vulnerable to tenure regulations. The school is already under pressure to reduce its faculty (by 6.6 next year), and cluster team teachers are perhaps more worried about their jobs than some others. Teachers who teach less academic courses (physical sciences as opposed to physics; basic math as opposed to trig or algebra) seem to feel the cluster scheme to be more of a threat than those who teach advanced courses. They are the teachers who tend to collect the most difficult students, in the main to teach in a more "traditional" manner (this is not intended as a criticism), and who most lack membership of a formal organisation within the school (the department system is weak and inevitably dominated by specialists; and they have, as yet, no organisation equivalent to the cluster team). Perhaps not surprisingly, such teachers often feel a slight sense of isolation within the school as a whole (formally, that is). Isolation shows itself in different ways: suspicion of outsiders and new plans, over-reaction to attacks on their authority, and a general skepticism about the motives and interests of anyone who seems as though they might be offering advice.

The administration feels it has been working hard to reach this group of teachers, despite occasional lapses on the part of individuals, when mutual feelings have been exposed. Nevertheless, it remains generally true that this group of teachers remains the one most neglected by curriculum development and innovation. In science at least, teachers in the more advanced and specialised classes have either tried the new curricula and found them wanting, or have worked to develop their own courses. The ninth-grade teachers seem headed in a rather different direction, being more conscious of cross-disciplinary issues and as concerned about teaching methods as about curriculum. Between them lie a number of teachers who seem mostly to stand outside the institutional spotlight, and have often become resistant to, and cynical about, talk of innovation or change.

Conversation 6
Teaching Methods in the Cluster

Teaching methods is an issue that emerged in several conversations between members of the cluster teams. The "conversation" reported here has been assembled from various fragments, and so lacks the authenticity of others reported in this section. I hope it is no less true. I have done my best to illustrate accurately what I think is an important emerging issue.

Civics Teacher: I feel constrained by the forty-minute period and the pressures of working in a building that is really only a heap of classrooms. I'd like to be able to get out more with the students and get to do more different things.

Science Teacher: I don't agree. I think almost the most important thing for the students to learn is the discipline of working in the classroom. When they come here at the beginning of the year they are all up in the air, and we have got to bring them down. You've got to get order and discipline before you can give it up.

Civics Teacher: By this time of year [March] they should have learned some sort of classroom discipline. The problem is that enforcing it starts to become an end in itself. You begin to forget about what you are trying to teach and just think about keeping a neat, orderly class.

Science Teacher: I don't just think of discipline as keeping an island of sanity in my class, whatever happens in the rest of the school. I don't think you can separate discipline in class from the discipline of the subject. In science especially, where you have expensive equipment and valuable things around, you have to learn certain ways of behaving and learning those ways of behaving are [sic] part of learning the subject.

Second Science Teacher: I'd like to get out of the classroom more because there are a lot of things I want to do that you can't very easily do in school. I think really the only way to get students to appreciate the significance of things like environmental pollution is to get them out of the classroom looking at it.

English Teacher: My classroom is important to me. I can't imagine a better place for doing the kind of teaching I want to do. Going outside the classroom on some occasions might have advantages. I'd like to have students going out to interview people, for example. But what they do in the classroom [which is mainly writing] has got to remain at the centre of everything else for me.

Civics Teacher: Sometimes I feel limited by the expectations the students have of me as their teacher. For most of them the range of things they will allow in a teacher is very limited and this makes it very hard to start anything new or different. The experience I have had in the past of working a lot outside school has shown me that you can have quite a different kind of relationship with students once you get them out of the school building.

English Teacher: I don't want a different kind of relationship. I want to be the kind of teacher I am.

Conversation 7
Solar Heating

Following the severe winter there had been a lot of talk in the press about alternative energy sources. One outcome was a scheme to award $400 grants to house owners who installed solar heating in their homes. Steve was very keen on the idea, not for his home but for the school. He thought perhaps he could get a grant from somewhere to install a prototype plant on the roof of the school, perhaps in conjunction with one of the local university engineering schools. Over the course of two cups of coffee and an unappetising sandwhich from the lunch room, he convinced himself the scheme was feasible. Someone suggested that if the plant could keep the coffee hot and keep its price down, he would get unanimous support from the faculty. Undeterred, Steve went off to lunch room duty still making plans.

Conversation 8
When is Trig, Trig?

Tom is a teaching practice student in the math department. He trained as an engineer and previously worked as a systems engineer for a computing company. One of the courses he teaches is in trigonometry:

> *I came here thinking that trig would be the course where I would really be teaching math, but I find the students have such a poor background in math that I'm really not teaching math at all. When students don't know how to multiply fractions, there seems little point in going on with cosines and tangents; so most of the time I am doing basic math with them, even though the course is called trig. I worry about the long term consequence of doing that, but the subject is fundamentally sequential. There's no point in going on until you have mastered each stage. I've tried individualising things for the students so that those who are ready can move on, but it soon gets very complicated, and I feel from the teaching point of view I need to keep them together as a class as much as I can.*

Conversation 9
Introducing New Materials

Bob, who teaches the advanced biology courses, has been teaching at the school for ten years. Three years ago he took a year off because he felt depressed at the way things were going and because he wanted to rethink his decision to teach in high school. You only have to spend a few minutes in his class to realise that he is an extraordinarily able teacher. He has an easy, good-humoured relationship with his classes; indeed, his third-year course was invented at the request of the second-year students who wanted to spend another year with him and pressured the system to provide it.

During the period of this study, he was running a very thorough and basically practical course in microbiology. He told one of the site visit team that he had not met any problems in obtaining and using any book he wanted ("I tried BSCS, didn't like the molecular biology version, but I found it was a lot of fun doing the one that was supposed to be the easy one"). The only exception was the area of human sexuality. Indeed, he explained he had just spent $104 of his own money buying a set of books for next year (the Saunderson Series). "Couldn't he have bought them through the school by requesting they be put on the list of recommended books?" the visitor asked. "I don't know how you go about doing that," he answered. At that point the head of science, who overheard the conversation, pointed out that in fact he was on the committee. Bob didn't know this, and it seems no one in the department knew, either.

Comments

The conversations I have selected here were those that were relevant rather than representative. Nevertheless, I have made something of a display of teachers' lounge conversation and I think I should suggest why I think it is important.

One reason is that, in the absence of a clearly structured bureaucratic organisation (there are very few formal meetings for most teachers), the conversations provide a point where information is communicated and where some kinds of consensus and conflict are generated. The school would be a less coherent organisation if the room (or something equivalent) didn't exist. The fact that, for me and at least some teachers, it is a pleasant place to be is quite an incentive for some. It eases the daily routine and provides a source of morale.

Observing David and Steve's lessons, I felt I could see the influence of their conversations on the way they taught. David's references to aerosol sprays in class, for instance, followed a conversation with Steve where Steve was urging that science teaching should connect up more with daily or political concerns. This interpretation may be quite wrong, but it suggests an interesting line of speculation. Many people agree that existing in-service courses have a limited effect on classroom teaching. Perhaps what we should do is consider those things that do influence what teachers do in class and see if there are any ways in which they can be supported or strengthened. ("How about an NSF project to foster and improve teachers' lounge conversations?" Steve suggested.)

POLITICS AND HISTORY: WHY ARE THINGS AS THEY ARE?

When the teachers tell you why things in the school are as they are, they invariably turn for explanation to the history of the school and the politics of education in the city. The longer they have been in the system, the more inclined they are to offer an analysis of long term historical trends. The younger teachers mostly tell of the political complexities of the last few years.

Bill Connors, head of science and a teacher at the school for more than twenty years (and before that a student in city schools), sees the present in terms of patterns established over three or four generations:

> *This city is a first port of call for immigrants, it always has been for more than 200 years. One group has always succeeded another. The Irish, the Chinese, the Jews, the Italians, then the blacks from the South, and now Puerto Ricans, West Indians and Haitians. As each group has arrived*

> *they have settled in an area of the city that, at the time, nobody else wanted and they have made it their own. But as soon as possible they have tried to get out to something better, to the suburbs, or another city or another part of the country. If they haven't made it out themselves, they have done all they can to get their children out.*
>
> *Those ethnic neighbourhoods still exist more or less intact, but most of the people who are left in them are the ones who have been left behind, in some cases for three or four generations. They know they are not going anywhere, but the thing that keeps them from being right at the bottom of the pile is that there has always been a new immigration of people who are different and who are consigned to an area that is even poorer than where they live.*
>
> *So in this city there has always been a mixture of the new immigrants coming in and immediately pushing to get out to something better, and seeing the school system as offering a way their children can get on, even if they can't make it themselves. And those who have been left behind, who know they are not going to make it, but who are determined that no one is going to take away from them the little that they do have.*

The pattern is a familiar one in the history of America, but in this city you sense that the historical process is still alive. Unlike some cities, Boston has never achieved great financial wealth or economic growth that might have deflected attention from the social process of assimilation. Through the sixties and seventies, immigration has continued. One of the younger teachers, a civics teacher, emphasises the point:

> *If you look at the records here, you'll find a high proportion of our students were not born in the city. People sometimes think that all blacks, for example, came in from the South in the sixties. In fact you find a lot of those families have already moved on. To the suburbs in some cases, but more often to Detroit or Canada, or even back to the South.*

Jim Kelley, a chemistry teacher at the school for sixteen years, agrees:

> *You know people talk a lot about "white flight," but it has always been expected here that people would move as soon as they got the chance. I grew up in an area that is now one of the "black ghettos," but the whites who left our street didn't leave because the blacks came. Long before that happened, they'd all planned to leave just as soon as they could. When I think of the kids I was at school with, they all said they would leave, and they all did. Except me I suppose, but I'm unusual because I came back; but not before spending some years in California.*

For the past three years the city school system has received national attention because of a federal court desegregation order imposed on the school board and the superintendent's office. Dennis, the civics teacher, says that having lived close to the problems for several years (as a union official he represents the union on the city's desegregation committee), he finds himself viewing it as a class rather than a racial conflict:

> *Three-quarters of the metropolitan population live in the suburbs, and that includes ninety-something percent of the middle class. Racial and ethnic divisions within the city function only to weaken the political position of the city relative to the state.*

Ultimately Dennis feels the only real solution to the problems faced by city schools lies in planning on a metropolitan, rather than a city, basis. But such solutions, he feels, are unlikely in the extreme; and he has to content himself with feeling optimistic about more minor changes, such as a much-publicised drift of a very small number of (mostly childless) professional middle class families back into the city.

Bill Connors is even more resigned. He doesn't feel that there is much that the schools can do to affect the real nature of the historical process, or perhaps much anyone can do. As is true for many other teachers in the school, his daily horizon is closer; the things that keep him teaching are not the hope of bringing about social change, but the fact that he enjoys what he is doing, likes the kids, and finds himself in a school where these things are still possible.

A growing trend in education, here and elsewhere, is that issues that were once thought of as purely educational or administrative, are now considered political. Recent events in the city exemplify the trend. Three years ago city schools were desegregated under a federal court order, a decision met by opposition and violence. One city high school still operated under the receivership of the court with a court-appointed administration. You need look no further than the local press to see how much education dominates city news. One week during the study, school-related issues accounted for 40% of the front page space of one of the city's leading newspapers.

In part this politicising of education reflects an unusual political and administrative system. The five-member city school board is elected on a city-wide basis and is able to determine its own budgets, free of constraints by the mayor and city council. The result is that the school board enjoys a high degree of centralisation, autonomy and power; and politics therefore enters education to a degree perhaps greater than in other places. Indeed, one of the key issues at the time of the study was whether the present system should be changed. The mayor, having served several terms and worked himself into a position of some authority, and perhaps hoping to catch the school board weakened by its failure to defend itself in the federal court, made a bid for charter reform. Anxious to gain some grip on the school system budget, the mayor suggested financial reform alongside more extensive representation on the school board. It was a move that created some unlikely alliances but met with little success after a promising start. For me, my confusion in the face of events illustrated how difficult it is for an outsider to interpret the local political process; for things have long passed simple confrontation and have moved into a realm of hyper-complexity.

Dennis, the civics teacher and union representative, is closer to the political process than most, but he shares the general sense of disbelief at the total prospect. Throughout the city, corruption seems rife; in fact, beyond the city, too (during the period of the study two state senators were found guilty of extortion and the county sheriff was forced to resign). Some people close to school system believed that the current chairman of the school board had paid $50,000 for the position, and that people regularly paid $10,000 for the position of principal. "Village politics on an urban scale" is how one local newspaper journalist put it in a radio interview.

As an outsider and foreigner, understanding little of the situation, I was easily shocked by such things. But perhaps what was most surprising was that, though the local press gave such stories considerable coverage, they rarely surfaced in day-to-day conversation. When they did, people's reactions seemed mixed and confused. Perhaps America has suffered a surfeit of such revelations in the last few years, for the main reaction was one of apathy, disinterest or despair.

THE REAL WORLD OF THE ADMINISTRATOR

During the site team visit, the high school principal expressed the view that a major problem with any proposals that might emanate from a body like the NSF was what he felt to be a lack of understanding of the work of the administrator in an urban school. He suggested both that national bodies should understand better the real world of the school administrator, and that they should consider the kinds of training available to people entering the administrative careers. The best he could find to say of his own experience of administration courses at three different universities was that they contained things that were interesting or helpful after several years experience of the work, or things that gave him some rationale for actions he would have taken anyway on the basis of professional experience. What seems to be lacking is understanding of the day-to-day routine of the administrator's life, and hopefully some ways of short-cutting experience. Mr. Henry, the high school principal, went on to say he had few positive suggestions to make himself. He felt internships might offer some answers, but what he was most keenly aware of was the shortcomings in the courses he had experienced. In particular, he felt inadequately prepared to deal with curriculum development, and with the press of daily crises.

A thorough exploration of this question is beyond the scope of this study; what can be offered, though, is some glimpse of the real world of the administrator framed by Mr. Henry's plea.

Snapshot 1

The principal sits in his wood-panelled office discussing the effects of next year's proposed cuts in the numbers of school aides with the two assistant principals. At his feet is the megaphone used the previous day for marshalling the school's occupants following an evacuation of the building for a fire alarm. Around the room are numerous photographs and a small collection of certificates. (Wallet-sized pictures of last year's graduating seniors slipped around the frame of a bulletin board, family pictures, photographs of the principal entertaining distinguished visitors to the school, a rather fine candid shot of the principal standing in front of the school listening attentively to a student, a more formal shot of him addressing the school.) A table loaded with impressive-looking sports trophies from the past; a beautiful vase standing over a foot tall with the face of its maker on each of four sides, which a student had presented to the principal after winning first prize in a city art contest.

It is 7:50 a.m.; Mr. Henry has been in the building twenty minutes andhas already spoken to more than twenty people. Every time he puts his head out of the door there are people waiting to see him: students, teachers, visitors to the school. Several people function to screen the waiting line; two secretaries, the two assistant principals and an administrative assistant. In an open area office, these things are handled delicately and informally.

Mr. Henry has a schedule for the day: a meeting with the two assistant principals, a meeting with the guidance staff, a meeting with a salesman from a yearbook publishing company; then at 1:30 he is going down to the school department offices, returning to the school later in the afternoon, and perhaps staying for a meeting of the parents' committee at 6:30. It sounds mostly routine, but there is no telling what incidents and events will punctuate the formal programme.

Already on his mind is a bomb threat. Last night he received a call to say a bomb would go off in the school at nine o'clock. There seemed to be no point in telling the police immediately, so he called them from home on his way into school. Two policemen were in the office when he arrived. After a brief meeting with the assistant principals, two teachers were sent out to tell one teacher on each floor of the building to check for any suspicious circumstances. "Look in the bathrooms and for any open locker doors," says Mr. Henry. It isn't an unusual indicent; he knows what to do, but there is always the thought that this one could be real. (I expected, around nine o'clock, to see him glancing nervously at his watch, but I don't think he looked once.)

Snapshot 2

A young teacher (female) from the bilingual department catches Mr. Henry as he puts his head out of the office door, to tell him there is a dead mouse in her classroom. "Call the custodian," someone says, to be met by laughter (an accepted school joke - the custodian can never be found). Mr. Henry says he'll deal with it, leaves the office and proceeds upstairs by way of the escalators. Once in the classroom, he puts the rather badly mutilated mouse in a stray paper bag and removes it to a downstairs trash bin.

The decision to go seems almost impulsive. A chance to escape the office, to see something of the school, and to be seen. A sure way of making sure that something actually gets done with the minimum of fuss and delay. A rare opportunity perhaps to do something concrete, tangible and useful. Perhaps also a chance to escape the confines and false dignity of the role.

Snapshot 3

During homeroom Mr. Henry picks up the phone in his office and dials into the school intercom so as to read the morning announcements. "Congratulations to the chess team . . . Would the basketball team report to the gym at one p.m. . . ." Part way through, his assistant adds some more notes to the pile and Mr. Henry switches to Spanish. When he has finished he calls to the assistant, "Hey next time give me some warning about that. My pronunciation is rusty, especially the numbers."

Snapshot 4

The visitor sitting outside the principal's room has not been to the school before and doesn't realise that it is the principal she has seen coming and going through the door. When she does enter the office, she can't get over her own sense of surprise that Mr. Henry is the principal. It isn't just the fact that he is younger than most people expect, but something about his personal style. Elegantly dressed in a three-piece suit, $45 shirt and handmade shoes, he could pass as a successful executive in any business outside education, and he can use his considerable charm simultaneously to create both informality and a sense of distance. The visitor says she finds it hard to express these things; it's just that Mr. Henry wasn't quite her image of a typical high school principal. She had the feeling of some dissonance between the man and his office, a lack of fit between the style of the person and the style of room.

Snapshot 5

In the meeting with two assistant principals, and again in the meeting with the guidance staff, there is no doubt that Mr. Henry is in charge. He listens patiently, sometimes attentively, conveying a lot through subtle shifts in varieties of the informal style that seems to be his hallmark.

"I've learned the management lesson of the sixties," he says, "which was how to humanise the administrator. But you can't run a fast moving school like this just by being human."

When he first came to the school he was unused to the scale and size of the place (2,300 students), having mostly worked in small scale settings. He says he had to learn to adjust to the workings of a large school while retaining his educational values. He came from an alternative school where people were closer, and inevitably more dedicated to teaching than teachers in a regular public school.

Snapshot 6

A teacher comes down to the office angry over a confrontation with a student and saying he is going down to the court office to file a complaint. Mr. Henry clearly feels that the teacher is overreacting, but clarifies the situation. Later he confronts the student, who comes down to the office even more angry and complaining that the teacher has been marking him down on his grades; independently he had taken his work to the head of department and had had this suspicion corroborated. Mr. Henry and the assistant principal argue the case with the student, trying to persuade him to stay with the class, even if he feels he is being discriminated against. The student, a mature older boy, finally breaks into tears. The student, the principal and his assistant are all black; the teacher, white. No one talks about it as a racial incident, but it is hard to tell what undertones the situation contains for those involved. The critical point perhaps is that it is not an incident that spreads, but is contained between the participants.

Snapshot 7

Following an in-service meeting in which one of the assistant principals (in Mr. Henry's absence) criticised the teachers for arriving late in the morning, a group of teachers in the teachers' lounge are discussing Mr. Henry as a principal. It is interesting that Mr. Henry isn't a frequent topic of interest or conversation amongst teachers. He presents himself in the role of trouble shooter and organisation man, perhaps feeling closer to the students than to the teachers. Any changes he encourages in either the school or the curriculum he tries to make sure are seen to come from the faculty rather than being imposed from above or from outside. Some teachers feel he has little understanding of what is going on in the school, and it is true that any vision he has for the school is something he tends to keep to himself. On the other hand, the teachers defend him in terms of the good image he presents to the outside. It is in the community and at the central office that the teachers see him as being highly effective. Perhaps paradoxically, he sees himself as an "inside man." Inevitably he occupies a salient position in the city. He is the youngest high school principal ever appointed, the first black, and the first outsider appointed in forty years. Like others who have risen rapidly to power, he lacks a penetrating informal network outside the school and fits uneasily into a system notorious for its patronage, insularity and corruption. (The students seem quick to make the inference. Two students waiting outside his office door compare him to President Carter; but as one points out, "his secretary, she don't look like no presidential secretary.")

ALTERNATIVE 1: OPENING THE CLASSROOM DOOR

In the late nineteen sixties and early seventies the curriculum development movement began to attract criticism on the grounds that it did not change school practice deeply enough to make a significant educational effect. Those in urban schools, particularly, argued that more basic changes were needed in the structure of relationships within the institution, and in the relevance of the curriculum. This wave of innovation (the alternative school idea, we might call it) seems to have left a deeper mark on the high school than the currriculum reforms that preceded it. In this section I hope to trace some of those marks.

Teachers who were teaching in the school through the late sixties still remember it as an unstable, but perhaps exciting, time. As we have seen, it was a period in which the school rapidly became predominantly black, and was then run down under various re-districting plans before being threatened with closure on the eve of its transfer into new buildings. In fact, in the court desegregation case that followed, the school was a key instance used by the judge to determine that the school board and the superintendent's office had deliberately acted to segregate the school system on racial lines. At the same time, campus unrest was at its peak, and the publication of a book by a radical critic of the city school turned the attention of radical students to the high schools. It is said in the high school that the rumour was that if the students could "break" their school, then the whole school system would be opened up to reform. At this time (the late sixties), the school had to learn to cope with infiltration and attempts to provoke student unrest, an experience that seems to have stood them in good stead some years later when busing was introduced. (Looking back to the press of the time, a recurring puzzle seems to be why this school did not experience more trouble. This seems to be part of the reason.)

Although the spread of student unrest to the schools seems to have been stopped in an organisational sense, many of the ideas have had an effect. The school is proud of the several alternative programmes that thrive within the organisation, and it is significant that the present principal previously worked in an alternative school in another state.

What were the ideas that eventually struck home? Well, they seem to be those things loosely grouped under the term "relevance"; a feeling that the normal school curriculum has little to offer most of the students. The students, critics said, were not asking for "new" math and science courses but were asking, "Why learn science at all?" That's a question teachers in the school still ask themselves with some seriousness, and many work hard on possible answers.

The MASH Programme

Chris is a biology teacher who works virtually full-time in the MASH programme. This programme, now two years old, was set up within the overall organisation of the school for students aspiring to careers in the medical field. None of the teachers who devised the original programme actually got to run it; and those teachers who do run it sometimes suspect it was put together with little thought that it would actually come to fruition. Chris is highly conscious of gaps that exist between the dreams of the planners and the daily reality.

Four teachers are involved (English, math, science and history), covering the required course areas. The students spend their mornings taking required courses, and their afternoons in work placements in various medical facilities.

Last year more than seventy students opted for the programme; this year more than fifty. But the nature of the students has changed. In the first year they tended to be the students no one else wanted; this year they seem more seriously engaged in the aims of the scheme. Although, to everyone's regret, they lack a space they can really call their own, away from the main school site, there is some feeling of community about the rooms they use. It is one place in the school you find an effort to display things on the wall, and to create spaces within classrooms using bookshelves, cupboards and potted plants. And it's a place you can find groups of students sitting around talking and socialising without being moved on by aides or teachers. Part of the problem, Chris explains, is that in working to create a different and more informal atmosphere, they inevitably attract students who are not in the programme but are just drifting around the school.

The main problem the programme faces is more crucial, however. As the teachers have interpreted the scheme, the essence of it was to be that the impetus and direction of the curriculum would develop from the work experience of the students. In this way they would meet the relevance question head on. As teachers, they saw their role essentially as a service role, building on the needs, queries, questions and difficulties met by students in their work.

Inevitably, a key prerequisite to the scheme was finding appropriate and stimulating work experience. This has been a problem. Despite the maze of hospitals that surround the school, physical proximity masks some enormous bureaucratic distances. Often, Chris explains, people at head-of-department level are helpful and even enthusuastic about the scheme; but the organisation then makes demands on the qualifications, behaviour and reliability of the students that are difficult to meet. Students often get placed in menial or routine jobs where they feel they are being used as a source of cheap labour, and where they complain of being badly treated by those in charge of them.

The teachers set out without a formal curriculum in the belief that the students would provide one from their work experience. Chris explains: "We expected them to come back full of questions; but because of the difficulties we had placing them, that never really happened. We found we couldn't arrange the mornings around the afternoons in the way we had at first hoped."

The MASH team's experience has been that a curriculum does not just grow out of a work-experience scheme. The exception has been the counselling aspect of teaching, talking to the students about the problems of placement, and particularly about the difficulties they met working with people who were mean to them, and about their frustration and disillusion at finding themselves in routine or boring jobs. The academic parts of the curriculum, however, just did not seem to evolve as readily as the designers of the scheme had hoped. The unresolved problem that remains is how to generate a science curriculum (or English, or math, or history) that is integral to the programme.

The two science classes I observed were in many ways relevant. Reviewing the topic of infectious diseases, Chris saturated the lesson with examples, from Legionnaire's Disease to Salmonella. He constantly explained things in everyday terms and with reference to hospital procedures with which the students were familiar. Yet the impetus and direction came from him; and although highly embroidered, the basic source was still a text book. Perhaps inevitably the students displayed the characteristic inertia and behavior of the classroom. (Exaggerated perhaps by having worked late into the night in some cases.)

"We thought experience would provide the questions and give the impetus to the curriculum," the English teacher in the programme explains. "In that way we could be sure that what we did was 'relevant,' and interesting, and useful."

"That didn't work out," says Chris, "and so now we have to create the energy and interest and enthusiasm here in school. And that is difficult to do as long as we are still inside and part of the institution, because the atmosphere we try and create here quickly gets dissipated."

He summarises the current status of the Alternative Programme; "Well, instead of the environment providing the input and the impetus to the curriculum, it has turned out the other way 'round. Now we not only have to teach them science, we also have to see them through the work experience. And we still haven't solved the problem of how to teach them science."

It would be wrong to be pessimistic about the programme at this stage. It may not have achieved what it promised; but it has got part of the way. My purpose in writing about it rather critically is to emphasise that the idea of "relevance" was used to attack the notion of schools as sources of culture, and to attempt to put them in a service role. The experience of this programme, however, has been that in some ways school has a greater potential as a source of human energy and motivation than the world of work. It would be a mistake to generalise too far from this point, but the point indicates an interesting, and for the schools, challenging direction.

(Note: An important element in the story is that Chris himself works in one of the nearby hospitals after school. In the way I have talked about the programme, it didn't seem appropriate to mention it; but my intuition is that it is a key fact in understanding the successes of the programme.)

The Urban Studies Centre

The Urban Studies Centre describes itself to potential students in the following terms:

> *Urban Studies is an innovative, alternative approach to education operated by the high school. At the Urban Studies city-wide resource centre, located in the political and historical heart of the city, students will study basic skills, will explore their own career potential and will utilise the resources of the urban environment. Frequent first-hand contact with the people and the places of the city and wide use of audio and visual media to communicate the special meaning of the city make this programme unique, timely and important for young people who are committed to the goals of the programme.*

The location turns out to be the top floor of an old school building currently housing part of a school under construction and other fringe activities looking for a home. No one in the building seems to know what anyone else is doing, which means students drift into Urban Studies from other places on occasion. Nevertheless, this is some kind of home to its students. The ones I talked to say how much better it is here than in the main school building. Here they belong, they know everyone, they have a place they can go and call their own. The teachers admit that some of the students are refugees from the size and scale of the ten-story building two miles down the road. As a visitor, I am struck by how much easier it is to talk to students here; two or three people tell me their life stories.

The teachers don't identify themselves by subject to any great extent. To some degree everyone teaches everything. The science teacher has a special interest in environmental studies, but he also spends much of his time with photography and television (one of the programme goals is that students should leave the Centre knowing how to operate and use a video-tape recorder). The morning I visited, he had all the students reading the morning paper and composing their own obituaries in the house style.

Relationships do seem qualitatively different here. Because there are no bells ringing, no mass movements of students, no pressures of things that need doing or places to get to, people seem to have more time for each other. There is a kind of celebration of the individual that is only possible in a small and intimate social enclosure. (People often talk of student:teacher ratios, but these are meaningless considered apart from the total size of the institution. Big institutions simply generate more things that need to be done, and more specialists, who by definition do things no one else knows about.)

Two senior students are talking to one of the teachers in a hallway. They are thinking of going to night school, both to pick up more points and to "keep clean." The teacher refuses to 'phone up for them. "I don't want to go to night school," he says.

> *I did it and it was a mistake. You think school is bad? I'm telling you night school is worse. The 'phone is in that room. Give them a call. Do it now. Not later. Now. Just don't ask me to do it. I've done my time. Go on, give them a call. Until you know what they are offering there's no point in even thinking about it. You can't even discuss it until you know what the options are. Call now. Use my name if it helps. Just don't ask me to do it because I won't.*

This brief encounter seems to illuminate the style of the place. Informal and humorous but with a relentless insistence on self-reliance. You can expect support and friendship from the teachers, but you have to expect to be independent; and that is probably the key fact that differentiates it from the main school, despite the complementary rhetorics of each institution. For despite the interest that the principal takes in what goes on here, it is clear that most teachers think of Urban Studies as some exotic (and perhaps for teachers, easy) option. The students, too, think of each place as different.

The scale is human rather than organisational, and that has some drawbacks. It makes it difficult to get away from people and means that in terms of formal curriculum choices students are in some ways limited (though many go back into the main school for various courses). Interestingly, the number of apparently college-bound students opting to come to the Centre seems to be increasing. Some students say it is difficult going back into regular high school courses after the independence of life in the Centre.

One of the teachers who has been here since the beginning claims that survival is the best test of alternative programmes. "We've been going six years, which is a long time in this business," he claims. He goes on to direct a specific plea to the NSF. "The foundations have never really supported alternative programmes within the public school system to any great extent. They have only supported private ventures designed for a small number of special kinds of kids."

Comment

MASH and Urban Studies indicate some of the ways the high school has changed in response to the educational criticisms of the past decade. It might be said that both are add-on responses and the school itself remains unchanged; but this is an open question, and simply the existence of the alternative programmes indicates that there is some cultural dynamic in the organisation.

It is perhaps important to note that where the curriculum reforms of the sixties found their main audience, and made their greatest impact, was on high status, high income, middle class school systems (witness PSSC, Chem. Study . . .). These were, after all, innovations that belonged primarily to elite groups: to the universities, the foundations, a few exceptional schools. In contrast, those innovations that have been developed from within schools or school systems seem to have been primarily of an organisational or administrative character. (And often directed at the powerless, the poor and the working class.) In both MASH and Urban Studies, curriculum issues, although they have been considered important, have been left to be thought out ad hoc, and secondary to more pressing organisational problems.

In the case of the high school, considering things in retrospect, it is clear that organisational changes have made a greater impact than purely curriculum changes. (All that is left of PSSC is a small collection of equipment in a prep room and some memories.) However, that doesn't mean that curriculum questions have been answered or that the issues have dissolved. In fact, the greatest successes seem to have come where both approaches have coincided, as in the conjunction of the ninth-grade cluster programme and the writing workshop.

ALTERNATIVE 2: BEYOND THE CLASSROOM DOOR

When you see things in yellow light, everything looks yellow or some shade of grey and black. In white light you can see all these different colours. They used to have street lights that were yellow like this, but people really didn't like driving along in yellow cars full of yellow people. So a light was developed that was almost white. But it wasn't quite white, it fooled your eyes into thinking it was white. If you look here you can see that it is mostly yellow and blue. Which rainbow colour is missing? Red, that's right. If you look at my face you can see it looks like I've been dead for two weeks. That's because my skin is reflecting blue light but not red. If you look up there at that ring on the wall, watch what happens to it when we go from this light to real white light. See, it goes from brown to red. (The children gasp in astonishment.)

The curriculum and the text are conventional enough and typical of many science classrooms, but the setting is different. Nearly 300 fifth-grade students and their teachers (from a number of city schools), are seated in an auditorium at the Science Museum watching a programme called "Good Vibrations," about the wave characteristics of light and sound.

The presentation is carefully assembled and well-rehearsed and it seems to capture the interest of the children. Once or twice the excitement of a few bubbles over and they have to be quieted down, but most of them are attentive and intrigued.

The programme is presented by a young man who succeeds in giving the impression that these are things that interest him. It is as though he is giving you a glimpse of his world rather than presenting something external and objective. Although there is a considerable element of showmanship built into the programme, it never reduces itself to a set of tricks and gimmicks. One of the teachers says afterwards, "He's more like another teacher than an actor."

The machinery is impressive: a sound synthesizer coupled to TV monitors, street size ultra-violet and sodium lamps, a double bank of coloured lights some ten feet tall triggered by different sound frequencies, and a burglar alarm which detects movement by ultra sonics. (One volunteer comes on stage and has to creep up on a balloon and burst it without setting off the alarm. To help her she sees her movements graphed on a TV monitor. Then the monitor is switched off and the children have to shout directions to her from another monitor only they can see.)

High frequency sounds show, to the children's delight, that they can hear things their teachers can't hear. "Just learn to talk in those sounds and you can talk all day in class without your teacher hearing you," suggests the programme presenter.

The presentation climaxes in a recording of the Beach Boys' "Good Vibrations" made visible both on the TV monitors and by a laser beam projected onto a speaker mounted at the back of the stage.

All fifth-grade students in the city come to see this presentation sometime during the year. I asked some of the students before they went in, if they knew what they were going to see; but no one had any idea. Most had been to the museum before with family or friends but couldn't remember much about it. (One girl suggested "Escalators, and a big balloon.")

I asked two of the teachers whether or not they planned their teaching around the visit at all. They said it was difficult.

There was so much to see in the museum and children's interests were so different; some were most interested in animals and others in something else. "A few years ago," one teacher explained, "city schools were very keen on science and we did quite a lot. Now the pressure is on reading and basic math. We have such a mixture of students in the school that we really have to concentrate on those things." The time this teacher has to give to one student during the museum visit illustrates the point. "He's a special needs student with a lot of problems: learning problems and emotional problems. I have to watch him because he might get into trouble just because he doesn't know better. We have three or four such students in each class."

After the presentation, the students disperse around the museum in small groups. "Three thousand is the most we let in," explains one of the education department staff, but most days there will be perhaps half that number." "I love to watch them," adds a colleague, "they smother the place." You can see what she means; everywhere you look there are little groups of children.

In the computer section the visual display offers you a choice between playing games, doing numerical calculations, or obtaining information about other museum exhibits. You select the one you want by pressing a single letter on the keyboard.

A boy, perhaps ten years old, stands in front of the display randomly pressing buttons, apparently confused that nothing happens. When he moves on, a high school student takes over. He, too, presses keys at random until a younger boy behind reads out the directions. The older student presses the key for games and is offered a choice of some eight alternatives. He wants tic-tac-toe, and presses the two keys that identify the programme. However, he presses the keys before the printout is complete, and each time he does so the moving spot returns to the start and delays the sequence. Increasingly frustrated, he starts pressing keys virtually at random, exacerbating the problem. Finally he pauses looking puzzled, the printout completes, he presses the keys and proceeds with the game. . . . Looking around the other terminals, it seems everyone else has chosen to play tic-tac-toe . . .

The area of the museum that deals with wave movements is darkened and spacious. In an open area under a spotlight is a large sand pendulum hanging over a slab of slate about one metre square, and set in a square trough about the same height above the ground. (There's a ledge, so small children can reach.)

On the edge of the trough are instructions. (Clean the slate of sand. Hold your finger over the nozzle of the container. Sieve sand into it. Hold it over the spot marked on the slate. Release it. Do not push it once it is moving.) You have to do these things in more or less the right order, and if you leave any out it doesn't work too well. The scale of the apparatus is such that it takes two or three children working in co-operation if it is to work. In addition, there is no clear goal in sight; for unless you've seen it before, there is no telling what it is going to do. It is interesting to watch what children make of it.

Three fifth-grade boys rush up to it, set the pendulum swinging, run sand through their fingers and then rush on to the big wave machine (a giant water tank with waves running through it).

Five girls, about the same age, cluster around the trough. One of them, Ann, quickly realises that the nozzle is blocked with grit and sets about clearing it. She gets it working and sets it swinging. "Oh! it's making a banana," one girl says. "A bunch of bananas," adds another. The cannister runs out of sand. Ann catches it and, with another girl, starts to refill it. The others wipe the sand off the slate with their hands. It quickly gets blocked again. Some of the girls are playing with the sand and tipping it on the slate faster than it gets wiped off. The teacher arrives and helps them sort it out by restoring some co-operation between them. "Hold it over the spot," she says (the teacher is the only person to read the directions). The spot is in one corner obscured by a patch of sand, but they think it is in the middle. The pendulum hangs there making a pile of sand. When Ann reaches out to push it the teacher stops her. "It says don't push it," she says. "What does it prove?" The teacher continues in response to her question, "that the earth is moving." Someone wipes sand from the corner and they discover the spot. They set it going, but after two oscillations the nozzle blocks again. Some of the girls drift off and the teacher follows. Ann wants to try again but everyone leaves. She stays a second longer, then rushes off to join her friends at the next exhibit.

The Wang computer is a little like a pocket calculator. On a table is a central electronic unit and around it a number of small terminals, each with a chair. There is a long set of directions you can work through to explore the characteristics of the machine.

At one terminal a boy sits filling up the display with digits and then clearing them. After repeated attempts he tries the other keys, add and subtract for example, and seems puzzled when nothing happens. The other functions (like squares) are more rewarding. When you press those the numbers move.

A small black boy comes running past, furiously mashes as many keys as possible, and darts off to another part of the museum. Hard behind him comes a teacher. "Come on," she says to the boy still sitting at the terminal, "keep up with us."

A large bearded man wearing glasses is sitting up on a dais in a corner of the museum. Next to him a column emits lightning sparks. As he talks, the flourescent light tube he is holding over his shoulder glows, even though it is not connected to anything. "If you had one of these in your house," he explains, "you wouldn't need electric wiring. You could just hang fluorescent tubes up with pieces of string, or stick them in flower pots." He goes on to explain that really the apparatus doesn't have much practical use except in research and Hollywood horror films. But a good bit of the time he tells stories about the man who first did these experiments. Nikola Tesla. "He used to invite people from industry and foundations who were sponsoring his work to visit him in his lab; and when they arrived, he'd have sparks flying everywhere. Everyone would be terrified, but he was always quite calm and cool because he knew what was safe. Once he had a gigantic spark that used up so much electrical energy that he burned out one of the generators at the power station in Colorado Springs where he worked."

The fifteen or so high school students sitting on the floor in front of him listen intently. Other people passing by stop to listen. Three museum attendants also come over to listen. Again there is a feeling of here is someone talking about something he really cares about. The eccentric figure of Tesla isn't just a joke or an entertainment, but someone the speaker feels some affection for, and perhaps identifies with to some extent.

The education department of the museum has a staff of eight who, between them, put on twelve programmes like "Good Vibrations" and a further twelve in the planetarium. These programmes cover the age range and subjects from insects to organic chemistry. The department also arranges Saturday morning classes (twelve in a series), lectures, short demonstrations like the one on Tesla coils, and an afternoon session for elementary school teachers.

The education department's aim is to produce programmes that are entertaining but which convey, as effectively as possible, key scientific ideas. Although they are carefully planned and well rehearsed, most of the staff like them to be interactive rather than simply expository.

Younger children dominate the clientele. "More than 65% of the students are from grade seven and below," estimated one member of the department. All students in the state are allowed one free visit per year, and teachers have free access to the museum, so the museum has a claim to being a significant element in the science curriculum of the schools. The education department is in an uneasy position, being closer to the audience than many other members of the museum staff, yet generally treated as service unit rather than central to the museum's function. Some members of the department would, nevertheless, like to work more closely with the schools, and sometimes feel a little frustrated at the limitations of forty-five minutes' contact with students they don't expect to see again. All the staff seem confident in their programmes and feel they are effective in getting across to the students. Many feel that is achievement enough (including the minority who come from a school teaching background), and suspect that their effectiveness is in part a function of social distance and limited contact. (Contact with schools is being extended through a magnet programme which brings particular schools into the museum more often [six times a year], and takes museum staff out into the schools.)

The in-service course for teachers is well supported (seventy-seven teachers this session). This year, for the first time, it is run in conjunction with a university, which offers two hours credit for the course. The prospectus describes it as offering "science ideas, activities and materials that have proved effective with elementary students, and is designed for the teacher with a limited science background." One of the staff describes it as aimed at "bolstering confidence." "Most of the teachers are women teachers who lack confidence in their own knowledge of science. They wouldn't have the confidence to sign up for a course at the Science Centre in CIS, but they will come here because it is neutral ground. We give them a shopping bag of things to take back to their classrooms to get them started."

Daniel grew up with the curriculum development movement. For five years he worked for EDC, first on Elementary School Science, and later on the African Primary Science Project. For the last few years, though, he has been working at the Children's Museum, an unusual and exciting place, part museum and part pre-school play center that occupies an old house in the city.

In the Science Museum the focus is clearly on science and things scientific; but in the Children's Museum, a smaller scale enterprise, the emphasis is firmly on children. The attendants are mostly young teenagers, and the clientele seem mostly in the three to twelve age range.

In educational terms the Children's Museum is a place that stresses learning rather than teaching. Daniel articulates his own philosophy eloquently:

> *I think we in America expect too much from our schools. The way I see it, there are two distinct systems involved in education. One is the learning of ways of conceptualising and categorising: what Bruner calls, "learning how to learn." The other is the development of personal metaphors for understanding the world.*

He thinks these two systems are really at odds with each other:

> *I don't think schools, or perhaps any other institution, can cope with the demands of both systems. Schools may be very good places for learning symbol systems for learning how to communicate, and for learning how to survive in our kind of society. They just seem to be rather poor places in which to learn science. The two different systems just are not compatible with each other. Learning in the sense of realising personal metaphors for understanding the world is, I think, best accomplishedin more intimate social contexts than you find in most schools.*

Daniel says he has been aware of this tension for some time; even in ESS there were some people who wanted to teach a particular concept, and who looked to the project for ways of illustrating or demonstrating it. Others, like Daniel, wanted children to learn from play; to be genuinely exploratory and to work from their experience of materials. Now, some years on, when he looks at the schools he finds it is the analytic, conceptual approach that (at best) dominates the curriculum. "I've given up on promoting play in schools," he says, smiling sadly.

Those who believe that the curriculum reform movement has failed to transform schooling still tend to see things in terms of schools and classrooms, Daniel, however finds himself increasingly turning to other, less formal and often less formalised settings in which to pursue his ideas. He believes that "schools cannot totally educate a child," and that much of what we learn, especially in the way of learning "personal metaphors for understanding the world," comes from settings other than school. He sees the best opportunities for the kinds of relationships and the kinds of learning he wants to develop in various forms of after-school day care; community centres and youth groups, for example.

In trying to explain this to people, he says the most difficult thing to establish is that such formally non-educational settings are conducive to real learning. "Some people seem to think that school is everything," he explains; "that school, and the school curriculum, contains everything that you learn. But I am inclined to think there's a lot you learn that comes from outside, but that we don't know how to recognise and use it."

A similar critique of schooling lay behind many of the free schools and alternative schools of early seventies. But Daniel's criticism of the public schools is not so much that they are wrong, but that they are concerned with different kinds of learning than those he thinks are important for personal understanding. To create new institutions, he feels, is not necessary; it would be much more effective to use what already exists. There are a wide range of existing and emerging groups and institutions, from Boy Scouts and 4-H to community centres and playgrounds, all of which have considerable educational potential. The problem is not to change organisations but to strengthen and "beef-up" what happens in those that already exist.

"You can spend a week and a half blowing bubbles in a community centre, and no one cares. But when I was teaching I once had a junior high math class blowing bubbles and had the parents 'phoning up the school to say that it wasn't their idea of what math was." Once out of schools, Daniel feels, a lot of the pressure to teach is lifted, and the kind of informal relationship that results is actually one that is much more conducive to learning than that which you usually find in a classroom. "Nevertheless," Daniel smiles, "a lot of my friends think I take the Boy Scouts too seriously."

Some of the education department in the Science Museum feel they could be more effective if their contact with children were more prolonged. Daniel has been able to work out some ways of doing this, partly through magnet programmes in the schools, but more often through extra-school organisations. The difficulty he has is partly one of funding; for unlike the Science Museum staff, he lacks a tenured job and a full-time salary, and has to look for grants and write proposals. "For such political reasons," he says, "I have to spread myself more thinly than I would like."

One project that has worked out well has taken Daniel back to considering the problems of teacher development. As part of his work with the Museum he runs workshops in science for people who work with children. Many of those who come are teachers, and at one time Daniel found that large numbers of student teachers from one of the local universities were signing up for the course, apparently as refugees from some of their formal courses. Daniel approached the university and worked out an arrangement whereby they pay for one and a half days a week in exchange for his running courses in elementary school science for their students.

The courses he runs are essentially practical: "You have to remember that most elementary school teachers are women, and it seems in our culture it's harder for women to play with materials in a problem-solving kind of way." Intimate first-hand experience of materials ("playing") is important to Daniel's view of what learning science involves; "but," he explains, "the science I am concerned with is science with a small 's'. It is finding out about the world in a playful manner. What you usually get in schools and colleges is science with a big 'S', which is concerned with concepts and categorisations and the relatinships between variables."

He feels it is important to approach the experience of materials through aesthetics rather than explanation. He stresses the ordinariness of many of the things he uses: starch, soap bubbles, milk cartons. "You've got to get teachers confident enough to play with materials," he says, "because they have got to be confident enough to get the materials into the hands of the students, and to tolerate them playing around with them." "Perhaps," he suggests, "if the NSF is serious about wanting to improve elementary school science, they should consider supporting the Women's Movement; at least until we get more men into elementary schools."

Around the room are some examples of the work that is going on in Daniel's courses. A tray of starch that has dried out to leave characteristic crack lines. ("It looks random at first sight, but there are some interesting patterns. Notice how the lines are mostly perpendicular to one another.") In a plastic bucket is a water wheel made out of milk cartons. When the wheel turns, it winds up a winch. (First of all you just play with it. Then you find, "Does it go further if you tip a cup of sand in slow, or fast? Do two cups wind it twice as far as one cup?" Once you get started, there's no end to what you can do.)

The problem with most teacher education courses, and with in-service courses, lies in the implicit view they have of the teacher. "Most of the teacher institutes I have had anything to do with," Daniel says, "have been concerned to promote or to implement some already worked-out curriculum. It is very rare for the people who are running them to find out where the teacher is, and start from there."

Specific Points of Recommendation from Daniel to the NSF

1. Consider the educational potential of existing after-school day care facilities. (In this city the early school hours brought about by busing have been a factor in increasing the demand for such facilities.)

2. Consider also the educational potential of other non-formal organizations like youth groups, the Conservation Corps, Boy Scouts....

3. Look more closely at the design and use of children's toys. Commercially available toys are increasingly programmed to a limited and restricted number of uses. This may be a more invidious influence on children's development than the often quoted effect of TV.

4. The problem of designing or providing toys for the handicapped provides a particular challenge/opportunity.

5. Teachers (at all levels) need more training in basic craft skills - from how to write at the blackboard, to 1001 things you can make with a milk carton. Knowing how to present children's work/ideas is a particular problem.

6. Despite the pressure to prune educational budgets, inservice education for teachers should be strengthened and supported. Decreased turnover and recruitment, and teachers staying in the same jobs, will be a key factor in the forseeable future.

7. Most elementary school teachers are women. The Women's Movement has a lot to say about the relation of women to science, and this should be taken more seriously in considering attempts to improve science education.

8. In-service education should start where the teacher is, not where we might like her to be.

BACK TO THE BASICS

One of the recurring themes as teachers (in science and in other subjects) talk about their students is the level of their reading and writing abilities. Some simply complain, feeling the fault lies elsewhere (in the middle and elementary schools, in the English and remedial departments, in the home, TV, comics...). Others, like David, feel that it is part of their job to make up or correct whatever has gone before, hence his emphasis on the written lab report. During the course of the study, Gordon Hoke wrote from the AASA Conference in Las Vegas reporting an NIE Study which showed "writing" as a critical area in which teachers felt standards were falling. (See Hoke's memo 3/3/77 in appendix.)

In this section I want to document this important distinction between the teaching of reading and writing as a specialist's field and the task of particular experts, and the idea of "every teacher as an English teacher." Both approaches are present in the high school in the form of complimentary innovations; and though examining them takes us out of the science department, the subject is certainly one that science teachers in the school consider vitally important.

The Reading Lab

The atmosphere in the reading lab is different from that in many classrooms. Students come in, pick up a file by the door and settle down to work in one of the language-lab type carrels. The teacher and the classroom aide move quietly and easily, seeming to be well on top of events and hurrying through the extensive paperwork the system generates. Sometimes at the start of the lesson there are signs of the characteristic "sitting around and goofing off and socializing" you see in most classes, but most of the time the feeling is of time being used intensively, of quiet concentration, efficiency and productivity.

The lab was designed by and is serviced by a private company in close consultation with a group of learning psychologists headed by B.F. Skinner. The work is divided into units and every ten units the students get a "free" period in which they can read magazines or play table games. After thirty units, and again after sixty, they receive a small signed certificate, not unlike those cents-off coupons you get for buying soap powder or dog food.

Bernie, the teacher in charge of the lab, describes some of the features of the system. It's good at placing students in terms of skill level, and it's good at diagnosing specific difficulties and providing specific help (for example, for students who have problems with long and short vowels). Most of the students who come through the lab are in the ninth grade (about two thirds), and sixty per cent of them are in the lower two thirds of reading ability when initially tested.

In most units students work from a cassette tape and work sheet, marking answers on a multiple choice sheet with a special marker pen that reveals true and false answers. It is possible to cheat; for by taking two answer sheets, students can use one as a trial and error test sheet in order to turn in a perfect copy. The classroom aide, who checks answer sheets and helps students with queries, has become adept at spotting cheating. "A lot of what I do is counselling," Bernie explains; "I tell them there is no point in cheating here; that they are only cheating themselves. I try to get them to be honest with themselves and take some responsibility for their own learning." (On the blackboard is inscribed the message: "Cheating on your tax return is dangerous. Cheating in Reading Lab is ridiculous.") For the students there are other ways of getting by. Another message on the board reads: "Music tapes will be confiscated until June." "Some students would bring in tapes to listen to; one even stole one of our tapes and recorded music over it," Bernie says; "but you could always tell. They were never able to sit still."

He admits that to some students the lab is a refuge:

> *It's one of the few places where it is quiet, you can sit down and no one will bother you. Sometimes we get students who will come in, put the headphones on and close their eyes; and when you look they have no tape in the machine. If they have been from lesson to lesson and had teachers shouting at them you can understand that. Another student who comes is an older, apparently college-bound student who doesn't seem interested in anything since his friend was killed in an automobile accident. He doesn't go to many classes but likes to sit in here with the headphones on.*

The lab is currently under financial pressure. It was installed less than a year ago on the initiative of the school department and against the recommendation of the principal and the English Department (who had an alternative proposal). It must have been expensive to install (I couldn't discover the dollar cost), and been seen by the company that produces it as an important contract (a recent Company Newsletter features photographs of the superintendent talking to Skinner).

Although teaching of the basics is a priority for the school system superintendent, the school board is under pressure to cut the education budget in the face of inflation and political demands. Currently they are considering closing the reading lab (which in this school costs around $10,000 a year to run), unless it can be shown to be cost-effective.

Bernie finds this situation uncomfortable. The gains on test scores are not dramatic, but he believes that a poor indicator of the effects of the system. "I don't want to make any grand claims for the system," he says, "I just know at this time, with these students, in this school, it works." He amplifies the point by asking how success can be judged or measured and what kind of comparisons make sense. "Compared to what went on before the system, compared to what we could do without it, compared perhaps to what goes on in other classes, I have no doubt that it is worth the money it costs. How do you measure it? Against how well children read? Against their attitude to reading as a whole? Or against the chances of them cleaving somone's head in?"

A lot of their success, he feels, has been with students who had got to the point where they wouldn't read aloud in class (and turned hostile when asked), and with students who have severe perceptual handicaps. Such students seem to respond well to the closed learning environment and the depersonalisation that results from separation of the teacher from the source of knowledge.

Clearly that is going to be a difficult case to make out to a school board hard pressed to justify inflationary budgets. (The loss of the investment cost as a criterion pales into political insignificance when set against the proposal to cut up to 410 teachers from the system next year.) Changes in atmosphere, climate or attitude are notoriously hard to measure, and their effects even more difficult to assess. Yet most educationalists habitually judge a school or a classroom by such elusive or subjective criteria in the absence of any more effective measure.

Behind Bernie's doubts about the measures used is the certainty that cost-benefit analysis is not being used to decide between alternatives, but simply as source of justification for making cuts. If the school loses the reading lab, it is unlikely to be able to use the money in another programme.

If criteria like attitude and climate are used in judging the success of the reading lab (or any other class), it is important to include the teacher as part of the subject of the evaluation. Is Bernie a reliable source of information? He doesn't seem to fit the stereotype of the ed tech learning scientist, or of the ambitious teacher riding an innovation to a brighter (personal) future. He lacks that air of loyal dedication to the system, and the bright light in his eyes when describing its virtues, that characterise the true devotee. Indeed as he describes how he came to the job, it seems that only gradually has he lost a sense of some distaste for the philosophy and style of approach that characterise the lab. Bernie's background is English ("Ultimately, I think getting students to write is more important than getting them to read"), but he also has extensive training (to PhD level) in educational administration, organisational theory and group behavior. After taking three years off to attend university, and unable to find the administrative job he wanted, he came to the school last year as an English teacher. Having chosen the job with some care, he says he was upset to find that the computer printout assigned him full-time to the reading lab. (Not a good start to a marriage with a new technology.)

After five months working in the lab he has modified his view of it. He still does not want to stay, even if he remains in teaching. "I am an English teacher," he says. "I like to teach a class. Here you never get the chance to be a performer." He also finds the highly structured nature of the materials somewhat limiting. "I suppose I could add to it, and improve it where I think it needs improving, but there is a limited satisfaction in that." Although he feels little personal stake in the future of the sytem, he feels he wants to defend it on its merits. Given the history of the innovation it is not difficult to find people who criticise the lab, mainly on the grounds that it failed to hold the low achieving ninth-grade students teachers feel it was primarily intended for. The head of science perhaps put Bernie's position best when he said, "Any teacher doing something they think is worthwhile gets to believe in it, and hates to see it go. In teaching you can't separate the person from the job like some administrators seem to think you can."

Sidetrack

I spent a morning with Hassler Whitney, mathematician and consultant to the project, in an elementary school that had the same learning laboratory system installed, both for math and reading. The school was apparently pleased with the system; certainly the teachers running it said they would not want to go back to regular class teaching (despite the mountains of paperwork). One of the other teachers, though, a math specialist, said he feared that the effect of the system was to threaten the expertise of the class teacher, a trend that already existed in math and which the lab reinforced; and he wondered about the long-term effect of this on the students.

Driving back across the city with Hassler, we were talking about these things, and trying to get some sense of what it was like for a student to learn math through such a system. Hassler was explaining to me how much of the students' time was in fact taken up trying to understand what the question was that they were being asked, rather than in any direct confrontation with mathematics. Suddenly he broke off and started telling me a story.

> *When I was a student I once cycled three miles to this street to see the number plate on a taxi. I was playing a game with myself where I was trying to collect the longest sequence of numbers I could from car license plates. I'd got to over 1,000 and I knew that there was a taxi that parked near here that would give me two numbers at once. What were the numbers?*

I thought for a while and suggested 11112, which would give 1111 and 1112. "That would be fine," said Hassler, "except that I hadn't got that far." For the next few minutes I thought around the problem and then went silent hoping he'd forgotten what he'd asked. After a few minutes' uncomfortable silence he asked me, "How do you feel about my question?" I confessed I was rather bored with it, felt he was playing games with me and I rather wished I could just guess the right answer or that we could talk about something else. "Now you know how those children probably feel about math," he said.

The Writing Workshop

The writing workshop is an idea and an approach rather than a place, and that makes it rather more elusive to describe. It seems to have grown out of the unsuccessful proposal made by some of the English teachers before the reading laboratory landed in the school, but has been developed in association with a number of faculty from one of the nearby universities.

The writing workship involves the ninth-grade English teachers. Although there are five such teachers, I talked only to one, June, who works on the same cluster team as Steve, the science teacher, and Dennis, the civics teacher.

There are no tricks and no technology to the writing workshop; not even any books. The idea is so simple it is difficult to describe and make credible. Yet it has a distant reality to both teachers and students, many of whom are highly enthusiastic about it. June has been teaching in the city for a number of years, but says this scheme has made it her best year yet.

The basic idea is for the students to write about the things they know about, and they progress from topic to topic starting by writing about someone they know, going on to describe events they have seen, to give someone instructions for carrying out a task, to describe a place, and so on. The list and sequence of topics is flexible and adaptable. As each student writes about each topic, they duplicate and collate the class's work in the form of a booklet.

It sounds a simple process but it has generated considerable enthusiasm. Students enjoy reading each other's work and look forward to each new topic. There is a feeling of corporate achievement and a developing sense of aesthetic standards. Both teacher and students are surprised at the quality of some of the work.

The class I observed was quiet, almost reverent. Throughout the lesson June went 'round the class talking in a low whisper. Primarily students were concentrating on their own work, though there was some exchange of writing and a little whispered discussion. One girl found it hard to concentrate, suddenly started writing furiously, and after covering two or three sheets of paper tore it up; but she failed to distract the rest of the class.

June said that all it took to start was two university faculty working in the school for two days getting the students started. Since then, supplies of paper and duplicating fluid permitting, it has continued to run smoothly.

The real test of the scheme is probably whether it will carry over into other classes. Its location in the clusters and the establishment of the daily team meetings would seem to promise well.

TWO STUDENTS

Helena

Elaine, or Helena as she sometimes prefers to be called, is in ninth grade. Most of her life she lived in California, where she mixed with a number of Chicano students. She says she still speaks "street Spanish," though not as fluently as she once did. "There was a time when I'd have to stop and think what language to use. Someone would ask me a question and there'd be a long pause before I'd answer!" When she's talking to other students you can still hear the Spanish intonation in her voice.

Helena is sixteen, having repeated a grade earlier in school. "I goofed around just like you see most kids doing." But now she feels straightened out, values what she gets from school and wants to make the best she can for herself from her education. The way she says it, it seems both an emphatic and fragile resolution. "I used to goof around but now I get straight A's. I like science best (because she thinks highly of Steve as a teacher), but my ambition is to go to Art College."

Helena seems unusual amongst the students in believing so strongly that school and education have something to offer to her. It's not just the job prospects she values, but the process of education itself. "I like to know things," she says; "When someone uses a word that no one else understands, but I know what it means, then I feel good. I like to be knowledgeable, to be someone that people know they can ask when they want to know something, whether it is the speed of light, or whatever it is."

The cost of being interested in education and valuing what the school has to offer is that it has cut Helena off from the social life that permeates school for most students. Helena says she doesn't mind being considered odd in this way. She says she doesn't have much time for students who treat school as a "fashion parade." "They spend all day criticising each other, saying, 'Ooh you've got too much makeup on!', or 'That skirt fights with that blouse, couldn't you get a better colour?'" That kind of thing is petty, she feels, and inappropriate to school. She comes to school in blue jeans and a shirt because she comes to work. "In the evenings I'll get dressed up if I'm going out somewhere, but I'm not coming to school in a fifty-dollar shirt."

Helena is articulate and headstrong, and some of the other students seem to find her a little overwhelming. She needs the attention and praise of adults to support her moral stand against her peers. The question she raised for me was whether the students who committed themselves to the explicit values of the school were those whose motivation stemmed to some degree from their alienation from their peers. Are the students who best succeed in academic terms often those who feel themselves misfits amongst other students?

Tony

Tony is a senior, president of the student council and one of the students most actively interested in science. Last year, as a science fair investigation, he worked on the separation and identification of bacteria. The project was demanding technically and required building a gas chromatograph "from bits and pieces lying about in the lab and any other parts I could persuade companies to give me."

Tony is in some ways a product of the curriculum reforms of the sixties. Unil two years ago he attended another high school elsewhere in the state, where he had been subjected to an intense college-bound curriculum. He took a BSCS advanced biology course in grade nine, and PSSC physics in grade ten. The biology course had included a four-month project. "I looked at photoperiodicity in animals, keeping hamsters under different lighting conditions and recording the effects on their offspring." It was a project that Tony says failed to reveal clear cut results, but led to the accumulation of "mounds of results and about 200 hamsters."

He says he first remembers getting interested in science when he was ten or eleven. His father was then in the Marines and they lived in North Carolina. "I used to spend a lot of time out in the woods; hunting, fishing or just walking about watching animals." He hasn't always seen himself as a scientist, however, for as a sophomore he took a number of language courses; and indeed one of his regrets about his present school is that it offers no way of continuing Russian.

Since coming to the school he has taken to chemistry, and spends much of his time with Jim Kelly. He works in Mr. Kelly's lab as a student technician (for which he is paid $30 a month), but he spends as much time there as he can. Perhaps more than anything else, it is Mr. Kelly's influence that has turned Tony to chemistry.

"He always helped me and encouraged me with my project, sometimes staying till eight or nine o'clock at night." When I asked Tony if he thought of Mr. Kelly primarily as a science teacher, or as a chemist who happened to teach, he said unhesitatingly, "as a chemist." "His home," he added, "is full of equipment. He spends most of his spare time, and a good bit of his salary, reading catalogues and science journals and buying science equipment."

Overall, Tony feels there are a lot of opportunities for students at the school, but that you have to push to get them. Through the flexible campus scheme he is taking a calculus course at a nearby State University, but he says he had to keep reminding people at school about the course in order to get in. "At my last school there were about twenty counsellors, and they kept at you all the time to get college applications in. It was a school where most students went to college and the school was all geared up for it. Here there are only three or four counsellors and most people are very busy. It means you have to do a lot of things for yourself."

Just before I left the school, Tony was offered places at both MIT and Dartmouth. He chose to go to MIT because of its emphasis on project work and teaching in small groups. His aim is to major in chemical engineering.

Sometimes science students are thought to be narrow-looking and not very socially inclined. Tony, though, is president of the student council and sits on a citywide Committee on Bilingual Education. He feels the lack of a social side to the school is one of the weaknesses of its citywide catchment area: "When school finishes at 1:40 everyone wants to go home. There's no neighbourhood feeling for the school. I'm the only one on our street who comes here. Most of the other kids near me go to parochial schools. At my last school it was quite different. Everyone knew what everyone else was doing. School didn't just stop in the afternoon when the bell went."

Tony is perhaps an unusual student. He would probably not be here if he hadn't transferred into a city school, for it seems likely he would have gone to the examination school across the street. However, his story does demonstrate that the school has been able to offer a high level education for those who need it. The question that remains is perhaps where Tony would be if he had spent all his high school years at the school and had missed out on the BSCS and PSSC courses at his previous school. What can be said is that he survived the turmoil of the new curricula and of desegregation with some success and with an education that promises some value for the future.

APPENDIX

To: Several People

From: Gordon Hoke-- 3/3/77

Re: A selective report on the annual meeting of the American Association
of School Administrators (AASA), Las Vegas, February 1977

Introduction

Issues of governance and problems of the economy dominated activities. In the opening general session, Ernest Boyer, new USOE commissioner, stated that "education in America is primarily a state and local function. Schools must be run by those who are closest to the people," Boyer continued, "and any move to 'federalize' this essential function must be vigorously opposed." Meanwhile, not far away, Los Angeles residents were indeed bitterly opposing a federal court order to desegregate its schools via busing.

I attended a variety of sessions whose messages, individually and collectively, could be placed within the context outlined above. They are cited in order of presentation.

1) Topic: "How To Regain Pride in Public Schools" Presentor: Ruth Love, Superintendant of Oakland, California public schools. She was the initial director of the Right to Read Program and is black.

A. Dr. Love declared that we are now "asking schools to do things we used to pray to God for." The 1960s War on Poverty did not attain many of its goals, she admitted, but it did open some doors for groups previously excluded.

B. She concluded by warning that "there are still many children who go to school but don't receive an education."

2) General Session--presentation by Carla Hills, formerly director of HUD, and prior to that period, Assistant Attorney General, U. S. Department of Civil Rights. In my judgment, she offered a series of powerful statements.

A. The quality of education in this country is directly tied to the future of urban life.

B. The underlying significance of Brown vs Topeka Board of Education--original desegregation suit--was not grasped: it was seen as an indictment of the South, not as a picture of northern cities.

C. Our nation still possesses "great creative vitality," but the central question facing us is "Will we sustain the effort needed to correct urban ills?"

D. Recycling a city is far less costly than building a new suburb, primarily because the former has all the essential infrastructures in place--e.g., sewer systems, streets, buildings, etc.

E. The answer to better education for city youth is not busing but a willingness to fight for the preservation of our cities. "The issues are not 'conservative' or 'liberal,' they are simply tough!"

F. There are positive signs, Hills stressed, including a new determination to conserve resources, the emergence of women in new roles, declines in family size, all of which reinforce values of urban living; however, she cautioned, there is a desperate need to streamline federal assistance programs created for the cities.

AASA ranks may conceal another problem, one which is common to so many professional associations. The majority of our youth live in cities, but their administrators and problems are underrepresented in the organization. Many of the delegates were from suburbs, rural districts, and small towns. If economic constraints continue to worsen, though, the need for both educational and tax reform could fashion a stronger bond of reliance and understanding across settings.

3) Topic: "Research Suggests These Steps to Improve National Tests" Presentor: Harold Hodgkinson, director of the National Institute of Education (NIE).

A. There is a need to distinguish between declining scores as reflected in the efforts of high school students and those of children in the lower grades whose scores are rising. Also, ACT and SAT scores are dropping, but PSATs are not. According to Hodgkinson, "no one knows why."

B. In a recent survey of college and high school instructors the following observations were obtained.

B-1) About 11 percent saw high school students less well prepared in social studies

B-2) About 17 " " " " " " " " " natural science

B-3) About 33 " " " " " " " " " mathematics

B-4) About 60 " " " " " " " " " writing skills

C. Hodgkinson sees the minimal competency demand for high school graduation as becoming a national trend and predicted it will produce new problems because (1) there is too much focus on easily measured items and (2) legislators are overlooking the importance of normative issues.

D. In the question and answer session, he was critical of test companies for "misusing" their wares for failure to explain tests and test information to students, parents, teachers, administrators and school boards.

4) Topic: "Responsiveness of Schools to Their Clientele" Presentor: Harmon Zeigler, University of Oregon. Zeigler and his associates have been conducting a study of decision-making in school districts since 1968. Initially, it was based on a survey of 100 sites based on a national sampling. They are now working with eleven of that original group, examining activities in each district throughout an academic year (nine months). Tentative findings:

A. State and federal agencies are playing a larger role in determining local policies.

B. The "definition of alternatives"--i.e., establishing the agenda for discussions of policy--is the key factor and this process is fundamentally controlled by the superintendent and his staff. Public participation usually occurs after the agenda has been established.

C. There is considerable variance in the amount of agenda items controlled by the administrative staff--e.g., seventy-three percent was highest, eighteen percent lowest, forty-seven percent average of the eleven districts.

D. Superintendents, Zeigler warned, face more demands for policy recommendations than do most chief executives.

E. Episodes marked by a high level of community involvement in controversial matters, often accompanied by national publicity, do not contravene indicators of low levels of sustained participation, Zeigler urged.

A superintendent responding to Zeigler stated that a truly "responsive" system is founded on the centrality of neighborhood schools, their principals and staff. However, there was no discussion of how busing and declining enrollments, for example, can complicate this approach.

5) Topic: "Equity and Collective Bargaining in Education" Presentor: Myron Lieberman, University of Southern California. Lieberman was one of the first representatives of higher education to enter the field of collective bargaining.

A. He views collective bargaining in education as beginning in 1962. Today about thirty-five states have legislation governing negotiations and approximately sixty per cent of teachers [illegible]red by these statutes.

B. "Equity must take into consideration all advantages and disadvantages of a situation." In Lieberman's judgment, public sector employees, including teachers, are now enjoying a number of benefits not found in the private sector.

B-1) Teachers can affect management, both locally and at the state level, via elections and the political process. Private employees cannot influence their management in this way. Through political action teachers are especially able to influence governors and legislators. This pattern is not true of industrial workers whose activities are governed by the National Labor Relations Board.

B-2) Public enterprises cannot move--as does private industry--to avoid labor demands.

B-3) Public employees cannot be fired without due process; private employees don't have same protection--e.g., teachers want both the right to strike and the protection of tenure. In short, Lieberman argued, although there is great variance among the fifty states, public employees have many statutory benefits without collective bargaining.

C. Public management too frequently buys off current costs, raises in current taxes, by giving handsome long-range benefits in the form of pensions, etc. In New York, ten percent of the state budget is now committed to this area.

D. Lieberman contends that states and local jurisdictions would find it cheaper to grant teachers "easier access" to strike calls.

D-1) Teacher strikes are "political" not "economic" weapons. They apply pressures on management but do not "measureably" affect productivity.

D-2) Enormous amounts of time, personnel, and resources are used up in moving through negotiations, impasse, fact-finding, mediation, etc. "The longer the bargaining process, the greater the likelihood that management will concede ground."

D-3) He regards binding arbitration as a "cop-out" and as introducing a third force into the governance structure. (In Pennsylvania, the state director of labor relations views the results of binding arbitration as "the annual rape of the public purse.")

D-4) Higher education has been of no help to public schools in this domain, Lieberman asserted, and some of its personnel are helping make the "third party" role one of the nation's leading "growth industries."

D-5) Collective bargaining has had a great impact on school policy and practice over the last fifteen years, and teachers have stressed that it has been done in the cause of improving things "for the children." But the political and legal basis for any union, Lieberman submitted, is the welfare and security of its members.

D-6) He concluded by saying that public management groups must get together and organize resources as do their adversaries in the bargaining process.

Summary

There was much talk about local control, but the operation of schools as a system is increasingly affected by influences stemming from their external environment. Collective bargaining, which links local teachers to state and national offices, and federal policy--e.g., desegregation, Title IX, the forthcoming Public Law 94-142 (handicapped)--are among the chief elements. There were indications at the AASA meeting, and in our recent work in Pennsylvania, that relationships between superintendents, boards, and teachers are stabilizing, but there were also signs that the combination of tough bargaining and decreasing funds is directly affecting the curriculum and particularly the ways in which it is delivered. In turn, one of the display booths at the Convention was manned by representatives of "The Citizens Lobby Against Unionism in the Public Sector."

GREATER BOSTON SITE VISIT REPORT

Introduction

On all too rare occasion, a quick visit to a school or classroom results in a written record worth reading. The unusual occurs in Ms. Steffensen's written impressions of a Greater Boston elementary school and a high school. The elementary school as an oasis in a slum is at once supported and challenged by her portrayal. The reader may find it useful to reflect on the fact that some of the children will go on to the "magnet" high school she visited.

The high school is seen as making the best of a difficult situation rather than as the leading edge of secondary education to which the best, the brightest, are drawn. Her view is particularly instructive where it contrasts with the report by the resident case analyst Rob Walker. This brief vignette illustrates the inherent strengths and flaws of case study methodology. It is less a matter of which viewer is right or wrong and more an issue of what is important to the observer.

Patriot Ridge Elementary School

Setting

A terrible area: slums, broken windows, litter, dogs going after garbage. During the course of the interview, one of the guards came in with an axe he had found on the school grounds, an enormous weapon that looked as if it belonged in a museum, certainly not in a school. However, once inside the door the scene is different, perhaps because the first sight is a beautiful display of student-produced arts and crafts which lines the hallway.

The principal conformed to the stereotype I have of women holding this position. She appeared to dominate the school and to have a great deal of authority. After the initial, rather over-bearing impression, I saw her as candid and pleasant.

The first order of business was a meeting with seven teachers, an acting assistant principal and an assistant principal, all of whom are enthusiastic about the school and are good spokesmen for it, and for the open-space classroom in general. The school has 1,000 students. It is in an area that is partially black and was integrated long before court-ordered desegregation in Boston. The school population is down from 1,300 to its present size of 1,000. Now in order to approach a specified balance, a few white students are bussed in. The make-up of the student population is 60% black, 20% white, 20% Spanish-speaking.

Science and Social Studies

I sat in on two science classes at Patriot, one a first "grade level," the other a fifth "grade level." The beginning lesson concerned the rotation and revolution of the earth. At most, about ten minutes of the class was devoted to review of these two concepts and their relationship to day, night and the seasons. The remainder of the forty-minute class was used in coloring a dittoed sheet that had very small pictures representing day, night and the four seasons. The teacher wrote "day, night, spring, summer, fall, winter" on the board. Some of the children wrote "summe," "might" under the wrong pictures. "Fall" was depicted by sheaves of corn. The assistant principal confirmed my suspicion that many of these city-born children would not know what these were.

The lesson was unimaginative, the noise level was very high because of the air conditioning, and many of the children did not seem to be hearing what was going on. Most of the teacher's remarks were inadvertently directed to the right half of the class, which didn't help. I asked a few of the children questions ("What happens when the earth goes around the sun?" "What comes after summer?"). It was clear that some of them didn't know the concepts involved. Others had been able to answer questions. On the whole, the lesson was a coloring exercise and spelling lesson (an ineffective one at that, since the teacher did not catch all the errors made).

One little girl, busily coloring the picture for spring, said to me, "It's stupid, it's all stupid." Where did she get this? She was enjoying the lesson, in spite of the fact that I wasn't. Did it come from her home, the other children? At this point I don't think these words meant much to her. If she says this frequently, it may affect her attitude toward school.

The level five science lesson covered making an electromagnet. The teacher had the children's interest; the class was quiet; it appeared they wanted to do the experiment themselves. The period was completely spent in demonstration, however, so the children were not able to make their own electromagnets. At the end of the period, they rushed over to the assortment of nails, washers, batteries and wires to look them over, and the teacher shouted, "Hands off!"

My impression is that the physical plant makes science difficult at Patriot. The science specialist wheels the equipment from one open-space area to another. Sometimes there is a problem with the elevator. The logistics of getting equipment to the teaching area for several different levels are demanding. The classroom areas are poorly suited to either demonstration or experimentation; it's hard to see and a lot of time is wasted getting things set up. The scheduling of classes also creates a problem. Because the five class groups in an area rotate between two teachers, if a period is missed it is difficult to make up that lesson. Furthermore, homework is rarely assigned since 800 children are involved and the same science teacher does not always see the same children the following week. An additional hurdle is articulation. Because some of the children move on to a different grouping while others remain in the same one at the end of the school year, the science teacher must vary her lessons somewhat from year to year, or she will have students repeating experiments. If she changes too much, though, any articulation that exists will be weakened. There is no text for science; at Patriot they use SCIS and Harcourt-Brace kits.

While the science at Patriot is not outstanding, the children here are clearly getting more than many elementary school children in greater Boston. When I spoke to one of the three science advisors at the school, he said that science education was not "equitable or efficient" in these schools. I could not get him to spell out what he meant by efficient, but he did say he had "seven times the energy" he was using. As for "equitable," he indicated that Patriot has three science advisors (who report directly to the District Department of Science) and two science teachers. Yet in the district there are very few science teachers; and apparently many of the schools do not use the services of the science advisors, who are not supposed to teach but only to support the teachers. According to the science advisor, many teachers "feel inept" in this area, a comment we've heard before.

A science enrichment program called "Ultra-Science" is presented in the building for Patriot and several other schools. Most of these schools were added this year in an effort to broaden the support base for the program and perhaps protect it against a proposed cut. The children have a half-day of Ultra-Science every five or six weeks. The facilities are exceptional: a child-sized planetarium, a green house and rooms for the physical and biological sciences. I did not see an Ultra-Science program, but the teachers assured me they were good. I asked which program the children were more likely to identify as "Science, the way she is." Most felt it was the week-in, week-out program, not Ultra-Science. The science advisor told me they attempted to have continuity in the Ultra-Science programs, in spite of the long time intervals between them. For example, they are presently studying the zodiac constellations, and the children look forward particularly to the presentation of their own sign.

I sat in on one social studies lesson. These are taught by the individual teacher, and what goes on in the class is up to the teacher. Some are interested in social studies and devote time to it every day; others appear not to. In the class the children had been studying the continent of Europe using a map traced by one of the children, and they were concentrating on England. During the forty-minute lesson the teacher used an overhead projector and a filmstrip. The children were attentive and seemed to be learning. At the end of the lesson, they listed differences and similarities between England and the U.S.A. The teacher told me he had done a unit on Africa, which he had timed to end when "Roots" was presented on TV. He said, "It was one of the best, most successful things I've ever done in my seven years of teaching." He coordinated art with the unit and had the children paint a mural depicting the descendants of Kunta Kinte. They also made masks and constructed paper plants and flowers so the room "looked like an African jungle." Parents who had been in Africa during the war brought in artifacts and talked to the class. Two months were spent on Africa, and the entire continent was covered.

The differences between the science and social studies classes that I observed emphasized again that the teacher is "the magic ingredient." Whether learning occurs or not is directly related to his imagination and understanding of his children. The teacher who taught the social studies class I watched said, "I was enthused about 'Roots' and the unit grew out of that enthusiasm. The children picked up my enthusiasm and they really got into it. But if I choose a topic in an area I can't get them interested in, I move on to another one."

A large number of books are available in each open area: the Fiedler series (Japan, Brazil, The South,...), Ginn (Your People and Mine), Laidlaw (Regions and Social Needs, Social Studies and Our Country,...).

The school system is highly politicized. This generally affects all in-school education, not just science. I will indicate a few of these effects briefly:

1. The following priority in space has been set: 766 children (referring to Massachusetts State Law for Special Education), bilingual program children, Title I children, everyone else. This means that space for the "garden-variety" kids (and science) is at the bottom of the list.

2. The teachers' union is strong and has succeeded in establishing a rule that teachers must not remain more than ten minutes after the last class. The schools empty fast. I asked the principal if there was any informal follow-up on the children and she indicated this was not possible because of time restrictions. The only ones they see are those who skip school to visit at Patriot. "I say to them, 'Besides being truant, how are you?'"

3. It seems very difficult for the schools her to get good newspaper publicity, but there is plenty of coverage of anything bad. For example, the above-national-average reading scores at Patriot were not reported, but the fact that a number of knives, brass-knuckles, etc. were collected was reported, with the important omission that these were gathered over a two-year period. In 1975-76, Patriot had a state grant to prepare a circular. It was distributed in the community by the students and teachers. Although the financial support did not come from the School Committee, that group did not approve the request for funding of this publication for 1976-77. Everyone is very discouraged about the situation. The school has stopped sending news items to the papers.

The High School

Quick Impressions

I sat in on five classes, two of which I would rate as disasters. The teachers lost control of the classes and there was little learning going on. A third class of the five, world history, was devoting fifteen (!!) class periods to an experimental program being developed by a major university--Life-Work Analyses. While it certainly is valuable for students to get some insight into possible career choices, one would question devoting three weeks of a world history class to this, especially since work on this was going to be included in their history grades. The students clearly saw the program as not related to world history. One student told me it was nice to have a break

While I was in that class, I spoke to one teen-aged girl who had completed the Analyses form sheets. She was very courteous and helpful, and went through it in detail with me. Her reading was quite poor. "Technician" was technika; "occupation," occupants; and "I don't like being photographed" was transmuted to "I don't like being photography." The discussion with her provided further challenge to some of the assumptions underlying the individualized instruction here. The first step in the Life-Work Analyses was to sort a number of cards showing various activities ("babysitting," "making posters," etc.) into high, medium and low interest groups. Then those choices were entered onto a grid of occupation areas. From this, one could determine his field of high interest, such as "helping," "arranging," etc. When the student pointed out which three areas she had pursued, I was surprised to see that she had chosen two in which she showed only moderate interest. She explained to me that she knew she was not interested in "figuring" because that involved math, even though she had chosen two math activities as being of high interest to her.

In the civics and American history classes I visited, both teachers initially lost control of the class, to the point that there was no instruction going on. In American history one student interrupted the teacher's discussion of Roosevelt's programs for economic recovery with, "May I interject? Who's going to the prom?" The class settled down once I was introduced. The students understood a number of the concepts, though they showed some factual misinformation. One girl knitted throughout the class period. While I was having lunch with the teacher, she said that she didn't like the lack of discipline at the high school, but a relaxed attitude was necessary to keep the school going.

In the class on consumer education (civics), the teacher never got control of the class, possibly because she had moved it to the cafeteria when her room became too warm. When we got there, the twelve students present fanned out over one-third of the room, and about three minutes was spent trying (unsuccessfully) to get them seated in one area. There was a perceptible degree of tension between the three white girls in the class, the teacher and the black students. By far, the most disruptive student was one of the white girls. In at least one instance when a student answered a question correctly ("Can you tell me one ad that appeals to your emotions or feelings?"), the teacher missed it, with the result that the class became confused and subsequent answers somewhat missed the point. I felt this teacher not only had problems in teaching but also in "reading" the people with whom she was interacting. Perhaps this was an exceptional day caused by the first balmy weather.

The law course I attended was superb. The teacher was covering the procedures involved in buying a house and began motivating the students by describing several situations in which the buyer could be "taken." The students were completely absorbed, and appeared to be learning the subject matter.

All the classes doing social sciences that I attended were completely lecture-discussion type, except for a civics class. There, the students also read aloud from their text, Law and the Consumer (Justice in America series). This was done, the teacher informed me, because the students' reading was so poor. One of the girls complained of laryngitis so she would not have to read. In that same class, one girl was not able to calculate 4% of $41. The teacher said she would help her with her math.

One of the first teachers I saw in the morning told me there was a great deal of racial tension in the area. He saw the press intentionally inflaming the situation to sell papers. My feeling was that most of the teachers were successfully handling a very difficult situation and were consciously adjusting their value systems to accommodate the rather different ones of their students.

Not a great deal happened in Rob Walker's life between the time of his Pine City case study and that of his Boston case study. (Hard to believe, considering he spent those four weeks in the cornfields of central Illinois!)

For information about the author, therefore, the reader is referred to the biography included in Booklet VI, "Case Studies in Education: Pine City."

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